PACIFIC SALMON COMMISSION
JOINT CHINOOK TECHNICAL COMMITTEE

ANNUAL REPORT OF CATCH AND ESCAPEMENT FOR 2016

REPORT TCCHINOOK (17)-2

May 19, 2017

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List of Acronyms and Abbreviations

AABM	Aggregate Abundance Based Management
ADF&G	Alaska Department of Fish and Game
Agreement	June 30, 1999 PST Annex and the Related Agreement
AUC	Area-Under-the-Curve
BC	British Columbia
CBC	Central British Columbia (Kitimat to Cape Caution)
CI	Confidence Interval
CNR	Chinook Nonretention
CR	Chinook Retention
CPUE	Catch per unit effort
CRITFC	Columbia River Intertribal Fish Commission
CTC	Chinook Technical Committee
CV	Coefficient of Variation
CWT	Coded Wire Tag
CY	Calendar Year
DFO	Canadian Department of Fisheries and Oceans
ESA	US Endangered Species Act
FNC	First Nations Caucus
FR	Fraser River
FSC	Food, Social, and Ceremonial
GMR	Genetic Mark–Recapture
GW	Gitwinksihlkw
IM	Incidental Mortality
ISBM	Individual Stock Based Management
JDF	Juan De Fuca
LAT	Low Abundance Threshold
LC	Landed Catch
LGS	Lower Strait of Georgia
LIM	Legal Incidental Mortality
MOC	Mid-Oregon Coast
MR	Mark–Recapture
MRE	Mature-Run Equivalent
MSY	Maximum Sustainable Yield for a stock, in adult equivalents
NA	Not Available
NC	North Coastal
NBC	Northern British Columbia (Dixon Entrance to Kitimat including Queen Charlotte Islands)
NMFS	National Marine Fisheries Service
NOC	North Oregon Coast
NWIFC	Northwest Indian Fisheries Commission
ODFW	Oregon Department of Fish and Wildlife
ORC	Oregon Coast
PS	Puget Sound
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
QIN	Quinault Nation
QCI	Haida Gwaii (Queen Charlotte Islands)
SIM	Sublegal Incidental Mortality
SMSY	Escapement producing MSY
SEAK	Southeast Alaska Cape Suckling to Dixon Entrance
SSP	Sentinel Stocks Program
SUS	Southern US
TBR	Transboundary Rivers (Alsek, Taku, Stikine)
TM	Total Mortality
UAF	University of Alaska Fairbanks
UGS	Upper Strait of Georgia
UMT	Upper Management Threshold
UMSY	Exploitation Rate at MSY
USFWS	US Fish & Wildlife Service
US	United States
WAC	Washington Coast
WCVI	West Coast Vancouver Island excluding Area 20
WDFW	Washington Department of Fish and Wildlife

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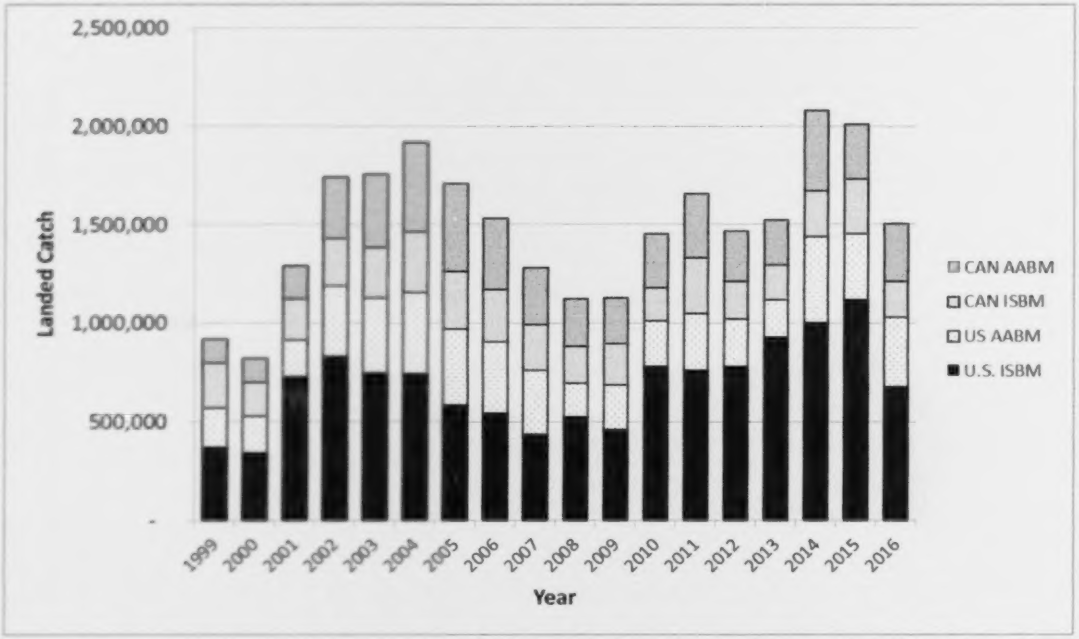
EXECUTIVE SUMMARY

The Pacific Salmon Treaty (PST) requires the Chinook Technical Committee (CTC) to report annual catch and escapement data for Chinook salmon stocks that are managed under the Treaty. The CTC provides an annual report to the Pacific Salmon Commission (PSC) to fulfill this obligation. This report contains three sections to provide an indication of stock performance in the context of management objectives for 2016: Chinook salmon catches, escapements, and stock status.

Section 1 summarizes fishery catches by region and available estimates of incidental mortality (IM) by fishery in 2016, with accompanying commentary on the fisheries, management, and derivation of IM. Annual catch data are compiled by Canada and the US for their respective jurisdictions within the PST area according to fishery regimes, regional locations, and gear type with estimates of IM. Landed catch (LC) is fully reported in the appendices for each geographic area covered under the PST; a summary for all PSC Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries, from 1999 to 2016, is provided in the figure below. Time series of available IM estimates are provided in Appendix A for individual fisheries. Appendix A also includes a coastwide summary of the historical time series of LC, IM, and their sum, total mortality (TM), across all AABM and ISBM fisheries.

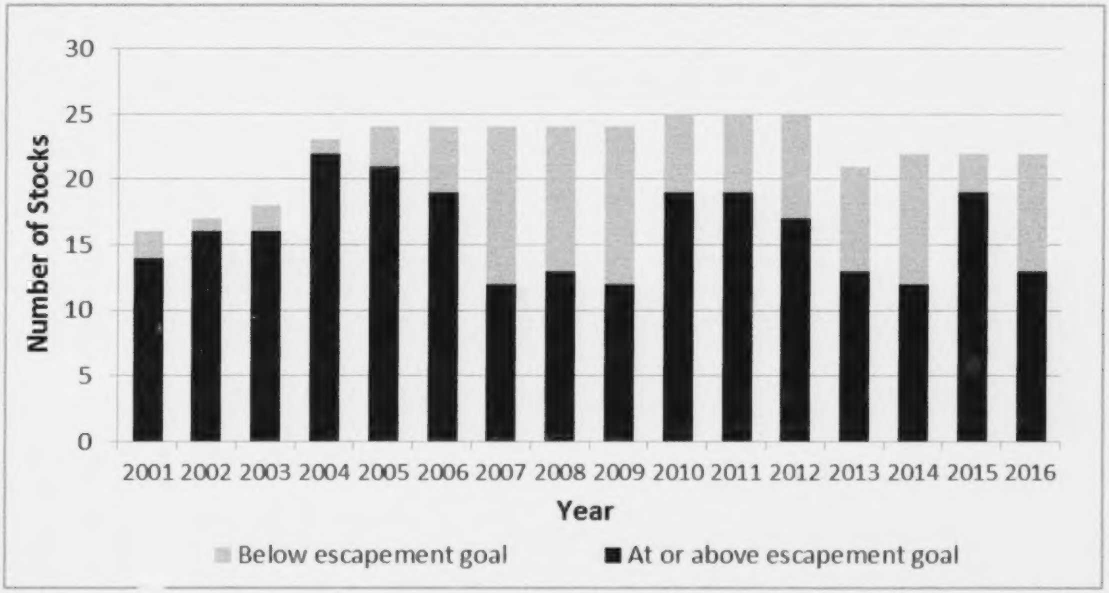


Estimates of landed catch for US and Canada AABM and ISBM fisheries, 1999–2016.

The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2016 is 1,504,640, of which 1,032,849 were taken in US fisheries and 471,791were taken in Canadian fisheries. Total estimated IM associated with this harvest is 188,383 nominal Chinook salmon. The TM for all PST fisheries in nominal fish was 1,693,023 Chinook salmon, of which 1,158,363 were taken in US fisheries and 534,660 occurred in Canadian fisheries. For US fisheries, 66% of the LC and 57% of IM occurred in ISBM fisheries; in Canada, 39% of the LC and 63% of IM occurred in ISBM fisheries. For some sport fisheries, 2016 LC and IM estimates are not yet available.

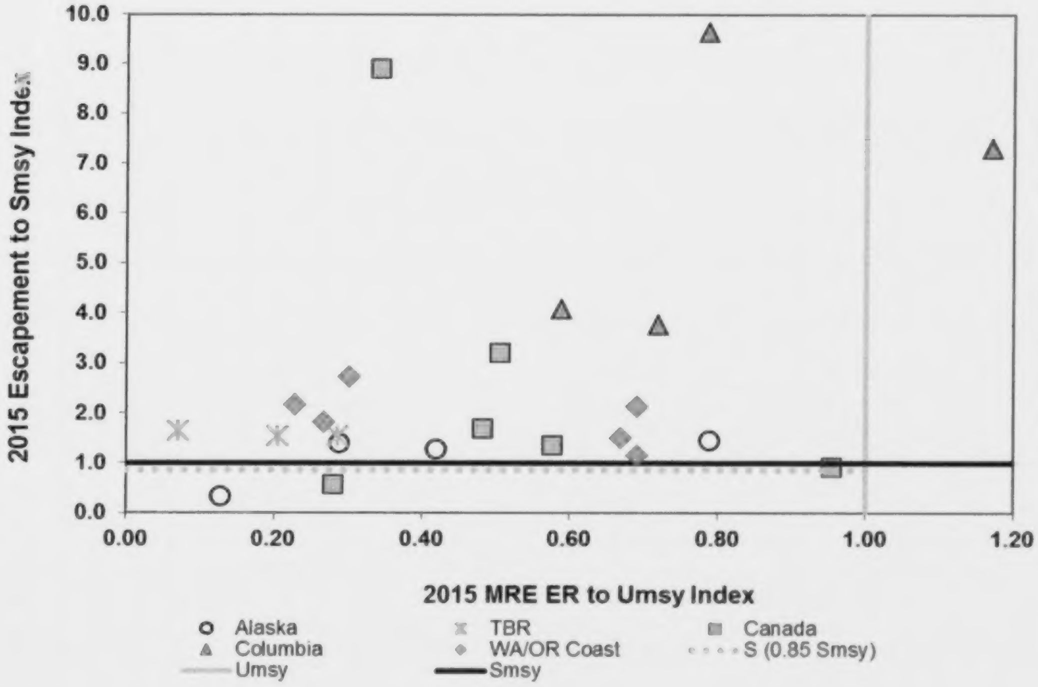
Section 2 includes an assessment of escapement for PST escapement indicator stocks/stock aggregates with CTC-accepted biologically based goals (22 stocks) as well as escapement data for the other indicator stocks/stock aggregates (24 stocks). For eight of the PST escapement indicator stocks/stock aggregates, the escapement goal is defined as a range; for the remaining 14, the escapement goal is the point estimate of S_{MSY} (escapement producing maximum sustained yield). Annual escapements that are more than 15% below the lower end of the range or the S_{MSY} point estimate are noted. The CTC will continue to review escapement goals for stocks as they are provided by respective agencies.

From 1999 to 2016, the percentage of stocks that met or exceeded escapement goals or goal ranges has varied from 50% to 96% (see figure below). In 2016, 13 of 22 stocks (59%) met or exceeded escapement objectives. Of the nine stocks below goal, one stock (Grays Harbor Fall) was within 15% of the target goal. Eight stocks were more than 15% below goal: Situk, Chilkat, Unuk, Chickamin, Alsek, Taku, Stikine, and Harrison. .



Number and status of stocks with CTC-accepted escapement goals, 1999–2016.The Keta, Blossom, and King Salmon rivers and Andrews Creek stocks were dropped as escapement indicator stocks in 2013 and Grays Harbor fall was added in 2014, bringing the total number of current indicator stocks with CTC-accepted escapement goals to 22 since 2014.

Section 3 presents a synoptic evaluation of stock status that summarizes the performance of those stocks relative to established goals over time for many of the escapement indicator stocks. This evaluation draws upon catch information (Section 1), escapement information (Section 2), and exploitation rates and other information to evaluate the status of stocks. Synoptic plots present both the current status of stocks and the history of the stocks relative to PST management objectives; this information clearly summarizes the performance of fisheries management relative to stocks achieving established or potential goals. A synoptic summary figure for 23 stocks with 2015 data shows that the majority of stocks were in the safe zone. No stocks were in the high-risk zone, two stocks (Situk and Nicola) were in the low escapement and low exploitation zone, and one stock was in the buffer zone (Cowichan). One stock (Columbia Summers) experienced exploitation above U_{MSY} and still the escapement exceeded S_{MSY} by more than 7-fold. The Southeast Alaska, Transboundary River, and Washington and Oregon coastal stocks clustered closer to the 1.0 index lines than the other regional groups. In general, Columbia River stocks showed a higher escapement to S_{MSY} index than the other regions where there was no pattern.



Synoptic summary by region of stock status for stocks with escapement and exploitation rate data in 2015 (escapement and exploitation rate data for each stock was standardized to the stock-specific escapement goal and U_{MSY} reference points).

1. CHINOOK SALMON CATCH

The 1999 Pacific Salmon Treaty Annex and the Related Agreement (Agreement) substantially changed the objectives and structure of the PSC Chinook salmon fisheries by eliminating the previous ceiling and pass-through fisheries and replacing them with Aggregate Abundance Based Management (AABM) and Individual Stock Based Management (ISBM) fisheries. The Agreement defines catch limits based on aggregate abundance for Chinook salmon in AABM fisheries, and requires that ISBM fisheries be managed on a national basis to meet stock-specific agreed-to maximum sustainable yield (MSY) or other biologically based escapement objectives (and/or exploitation rates for 4 of the 49 named stocks) or to limit adult equivalent mortality rates for these stocks to a portion of the 1979 to 1982 base period or the average 1991 to 1996 rate. The 2009 Agreement imposed additional reductions to catch limits in West Coast Vancouver Island (WCVI) and Southeast Alaska (SEAK) fisheries.

This report assesses landed catch (LC), incidental mortality (IM) and total fishing mortality (TM) for all Pacific Salmon Treaty (PST) fisheries in 2015, both those targeting Chinook salmon (Chinook Retention; CR) as well as those directed at other salmon species (Chinook Nonretention; CNR). The LC, IM and TM estimates for the three AABM fisheries are presented by gear sector in Table 1.6 and Table 1.7 and similar estimates for Canada and US ISBM fisheries are summarized in Table 1.8 and Table 1.9. A summary of LC, IM, and TM estimates for Chinook salmon in all PST AABM and ISBM fisheries is presented in Table 1.10.

The CTC began reporting IM in AABM fisheries in 2004 (CTC 2004a) and in most ISBM fisheries in 2005 (CTC 2005). The current reporting of LC and IM estimates provides a comprehensive overview of all PST fisheries that harvest Chinook salmon. Commentary is provided to explain fisheries, management, and derivation of estimates of IM. Historical LC, IM, and TM data are given in Appendix A.

1.1 REVIEW OF AGGREGATE ABUNDANCE BASED MANAGEMENT FISHERIES

AABM fisheries for Chinook salmon are managed to an allowable catch associated with an annual abundance index (2009 PST Agreement, Annex IV, Chapter 3, Table 1). AABM fisheries are mixed stock salmon fisheries that intercept and catch migratory Chinook salmon from many stocks. There are three AABM fisheries (2009 PST Agreement, Annex IV, Chapter 3, paragraph 2):

(1) Southeast Alaska (SEAK) All Gear (Troll, Net, Sport)

(2) Northern British Columbia (NBC) Troll and Haida Gwaii (QCI) Sport

(3) West Coast Vancouver Island (WCVI) Troll and Outside Sport

Catches for these three fisheries are reported in Table 1.1.

Table 1.1.–Annual catch and hatchery add-on for AABM fisheries expressed in thousands of Chinook salmon.

	Southeast Alaska (T, N, S)			Northern British Columbia (T), Haida Gwaii (S)		West Coast Vancouver Island (T, S)	
	Treaty Catch		Hatchery	Treaty Catch		Treaty Catch	
Year	Limit[1]	Observed	Add-on[2]	Limit[1]	Observed	Limit[1]	Observed
1999	184.2	198.8	47.7	126.1	84.3	107.0	38.5
2000	178.5	186.5	74.3	123.5	32.0	86.2	88.6
2001	250.3	186.9	77.3	158.9	43.3	145.5	120.3
2002	371.9	357.1	68.2	237.8	149.8	196.8	157.9
2003	439.6	380.2	57.2	277.2	194.8	268.9	173.6
2004	418.3	417.0	76.0	267.0	241.5	209.6	215.3
2005	387.4	388.6	64.3	240.7	243.6	179.7	199.5
2006	354.5	360.1	48.4	200.0	216.0	145.5	145.5
2007	259.2	328.2	68.4	143.0	144.2	121.9	140.6
2008	152.9	172.8	66.1	120.9	95.6	136.9	145.7
2009[3]	176.0	228.0	61.9	139.1	109.5	91.3	124.6
2010	215.8	230.8	53.4	160.4	136.6	142.3	139.0
2011	283.3	290.7	65.6	186.8	122.7	134.8	204.2
2012	205.1	242.5	51.4	149.5	120.3	113.8	134.5
2013	284.9	191.4	65.6	220.3	115.9	178.8	113.6
2014	378.6	435.2	56.6	262.6	216.9	191.7	188.4
2015	337.5	335.0	68.1	246.6	158.9	179.7	116.7
2016	288.2	353.7	35.1	183.9	190.2	104.8	99.6
2017	209.7	TBA	TBA	149.5	TBA	115.3	TBA

Note: T = Troll, N = Net and S = Sport fisheries.

[1] Allowable treaty catches corresponds to the first postseason abundance index for years 1999 to 2015 and the preseason abundance index for 2016.

[2] Treaty catch does not include hatchery add-on or exclusions (see Table A1).

[3] 2009 was the first year the 2009 Agreement was implemented.

1.1.1 Southeast Alaska Fisheries

The SEAK Chinook salmon fishery is managed to achieve the annual all-gear PST allowable catch associated with the preseason abundance index, which is generated by the PSC Chinook model each spring. Catch is allocated through regulations established by the Alaska Board of Fisheries among troll, net, and sport fisheries. The current allocation plan reserves 4.3% of the total all-gear catch for purse seine, 2.9% for drift gillnet, and 1,000 fish for set gillnet fisheries. After the net quotas are subtracted, 80% of the remainder is allocated to the commercial troll fishery and the other 20% to sport fisheries. The commercial troll and net fisheries are managed inseason according to procedures outlined in gear-specific management plans. Sport fishery bag and possession limits as well as annual limits are established prior to the season based on the preseason abundance index. The regulatory history and maps for each SEAK fishery are presented in CTC 2004b. In addition, the SEAK AABM fishery is managed for the following:

(1) Alaska hatchery add-on (CTC 1992) and exclusion of Chinook salmon catches in selected terminal areas (CTC 2004b)

(2) compliance with provisions established by the National Marine Fisheries Service (NMFS) in accordance with the US Endangered Species Act (ESA)

(3) consistency with the provisions of the PST as required by the Salmon Fishery Management Plan of the North Pacific Fishery Management Council that was established by the US Magnuson-Stevens Act

The preliminary total all-gear catch in 2016 was 389,472, with a PST catch of 353,704, an Alaska hatchery add-on of 35,104, and a terminal exclusion catch of 664 Chinook salmon. SEAK Chinook salmon catch from 1975 to 2016 are reported in Table A1.

1.1.1.1 Troll Fisheries Catch

The troll fishery accounting year began with the start of the winter fishery on October 11, 2015, and ended with the summer fishery on September 30 2016. The winter troll fishery continues until 45,000 Chinook salmon are caught, or through April 30, whichever is earlier. In 2016, the winter troll fishery was open through March 8. The spring fishery, which is managed to maximize the harvest of Alaska hatchery-produced Chinook salmon, was conducted from April 15 to June 30 in a total of 36 spring areas and six terminal harvest areas (Skannes and Hagerman 2016). There is no cap on the number of Chinook salmon that can be harvested in the spring troll fishery. The percentage of Alaska hatchery fish in each area is monitored on a weekly basis and only areas that meet predefined thresholds are left open. The 2016 summer troll fishery included two Chinook salmon retention periods which occurred from July 1 to July 5, and August 13 to September 3. In recent years, a small portion of the troll fleet has targeted chum salmon from mid-June through August, resulting in a decrease in effort directed at Chinook and coho salmon (Skannes et al. 2013).

In 2016, the troll fishery harvested 276,432 Chinook salmon, which included 13,778 Alaska hatchery fish. There was an Alaska hatchery add-on of 10,391 and a terminal exclusion catch of 33 fish, and subtraction of these from the total harvest results in a total of 266,088 PST fish. The winter fishery harvested 52,291 fish, of which 2,642 were from Alaska hatcheries and 50,305 were PST fish. The spring fishery caught a total of 42,782 fish, of which 8,974 were Alaska hatchery fish and 35,968 were PST fish. The total summer catch was 181,359, of which 2,161 were from Alaska hatcheries and 179,735 were PST fish (Table 1.2).

Table 1.2.–Harvest of Chinook salmon in Southeast Alaska by gear type in 2016.

Gear	Total Catch	Alaska Hatchery Catch[1]	Alaska Hatchery Add-on[1]	Terminal Exclusion Catch[2]	AABM Catch[3]
Troll					
Winter	52,291	2,642	1,986	0	50,305
Spring	42,782	8,974	6,781	33	35,968
Summer	181,359	2,161	1,624	0	179,735
Troll subtotal	276,432	13,778	10,391	33	266,008
Sport[4]	70,777	10,300	8,287	0	62,490
Net					
Set Net	230			0	230
Drift gillnet	13,789	9,489	8,466	632	4,692
Seine	28,244	8,303	7,959	0	20,285
Net subtotal	42,263	17,793	16,426	0	25,206
Total	389,472	41,871	35,104	664	353,704

[1] The add-on is the total estimated Alaska hatchery catch, minus 5,000 base period Alaska hatchery catch, and minus the risk adjustment (product of standard error for the total estimated Alaska hatchery catch and a risk factor of 1.645).

[2] Terminal exclusion catch is a result of the harvest sharing arrangement on the Taku and Stikine rivers.

[3] Treaty catch is the total catch minus Alaska hatchery add-on minus terminal exclusion catch. Totals may not equal the sum of the individual values due to rounding.

[4] Preliminary values until mail-out survey results are available.

1.1.1.2 Net Fisheries Catch

There are three types of commercial net fisheries conducted in SEAK: purse seine, drift gillnet, and set gillnet. With the exception of directed gillnet harvests of Chinook salmon in SEAK terminal areas as provided in the Transboundary Rivers chapter of the PST, harvests of Chinook salmon in net fisheries are incidental to the harvest of other species. The 2016 total net catch was 42,263 Chinook salmon, including 17,793 Alaska hatchery fish. There was an Alaska hatchery add-on of 16,426 and a terminal exclusion catch of 632, resulting in a PST catch of 25,206 (Table 1.2).

The purse seine fishery is open from mid-June through early fall and is limited to specific areas and time periods established inseason by emergency order (Gray et al. 2015a). In 2016, the purse seine fishery harvested a total of 28,244 Chinook, which included 8,303 Alaska hatchery fish and an Alaska hatchery add-on of 7,959, resulting in a PST catch of 20,285 (Table 1.2).

The drift gillnet fishery usually opens in late June, unless directed fishing is implemented in May to target surplus production of Chinook salmon bound for the Taku and Stikine rivers (Gray et al. 2015b) as detailed in Chapter 1 of the 2009 Agreement. In 2016, the preseason terminal run forecast for the Taku River did not provide for an allowable catch, however, the preseason terminal run forecast for the Stikine River did provided for an allowable catch of 10,272 Chinook salmon. The SEAK drift gillnet fishery is limited to five traditional areas and time periods are established inseason by emergency order (Gray et al. 2015b). The 2016 drift gillnet fishery caught a total of 13,789 Chinook salmon, including 9,489 Alaska hatchery fish. There was an Alaska hatchery add-on of 8,466 and a terminal exclusion catch of 632, resulting in a PST catch of 4,692.

The set gillnet fishery is managed to catch no more than 1,000 Treaty Chinook salmon, a limit which is based on an historic average. This fishery is open during the late spring and summer in the Yakutat area. The 2016 set gillnet fishery caught 230 Chinook salmon, all of which were PST fish.

1.1.1.3 Sport Fishery Catch

Sport catches are monitored inseason by catch surveys throughout the region and sampling programs are in place to recover coded wire tags (CWTs) from tagged Chinook salmon. The number of Alaska hatchery fish caught is estimated from the CWTs collected by the sampling program. Preliminary sport catch estimates are computed from the catch surveys while final sport catch estimates are computed from a mail-out survey and are available one year after the fishery occurs. In 2016, the management plan required a daily bag limit of three Chinook salmon 71 cm (28 inches) or greater in length (tip of snout to fork-of-tail) for resident anglers during May and June and 2 fish daily as of July 1, 2016. The nonresident angler daily bag limit was two fish during May and June and one fish thereafter. The nonresident annual limit was six Chinook salmon during May and June which was reduced to three Chinook salmon as of July 1. In addition, residents were allowed to use two rods from October through March. In some designated harvest areas near hatchery release sites, bag and possession limits and annual limits were liberalized to provide increased catches of returning Alaska hatchery Chinook salmon. The preliminary 2016 total sport Chinook salmon catch was 70,777 with an estimate of 10,300 Alaska hatchery fish. There was an Alaska hatchery add-on of 8,287 fish, resulting in a catch of 62,490 Treaty Chinook salmon (Table 1.2).

1.1.2 British Columbia Fisheries

The NBC AABM fishery includes NBC troll catch in Statistical Areas 1–5 and QCI sport catch in Statistical Areas 1 and 2. The total NBC AABM catch in 2016 was 190,181. The WCVI AABM fishery includes the WCVI commercial and First Nations troll and a portion of the WCVI sport fishery (defined below). The total WCVI AABM catch in 2016 was 99,650 (Table 1.3).

1.1.2.1 Northern British Columbia AABM

The total NBC AABM catch (troll plus sport) between October 1, 2015 and September 30, 2016 was 190,181 Chinook salmon (Table 1.3).

Table 1.3.–Harvest of Chinook salmon by gear for Northern British Columbia AABM fisheries in 2016.

NBC Fishery	Landed Catch	Legal Releases	Sublegal Releases
Troll			
Summer	147,381	1,510	21,353
CNR Troll	0	0	0
Troll subtotal	*147,381*	*1,510*	*21,353*
Sport	42,800	29,711	0
TOTAL	**190,181**	**31,221**	**21,353**

1.1.2.1.1 Northern British Columbia Troll Fishery Catch

The NBC troll fishery landed 147,381 Chinook salmon during openings for Chinook salmon fishing from June 21 to August 1 and from August 25 to September 30, 2016. The entire 2016 NBC troll fishery was conducted under a system of individual transferable quotas. All landings of Chinook salmon caught in the NBC troll fishery were made at designated landing sites and catches were validated by an independent contractor. Validation of landings has occurred since 2005. A total of 228 licenses were issued, but the total catch was landed by 136 vessels because much of the quota was transferred. Barbless hooks and revival boxes were mandatory in the troll fishery and the minimum size limit was 67 cm fork length (26.4 in). No troll test fisheries were conducted in 2016. A ribbon boundary around Langara Island and from Shag Rock to Cape Knox on Graham Island excluded the commercial troll fishery from areas within one nautical mile of the shore from June 21 to September 15, 2016. A ribbon boundary from Skonun Point to Shag Rock on Graham Island excluded the commercial troll fishery from areas within one nautical mile of the shore from June 21 to September 10, 2016.

1.1.2.1.2 Northern British Columbia Sport Fishery Catch

Sport caught Chinook salmon from Haida Gwaii (Pacific Fishery Management Areas 1, 2, 101, 102 and 142) are included in the AABM totals. Catches in the Haida Gwaii sport fisheries have been estimated since 1995 through lodge logbook programs, creel surveys, and independent observations by Canadian Department of Fisheries and Oceans (DFO) staff. The 2016 Haida Gwaii sport catch was 42,800 Chinook salmon.

1.1.2.2 West Coast Vancouver Island AABM

Under the 2009 PST Agreement, the WCVI AABM fishery includes the WCVI troll and the outside WCVI sport fishery (defined below). The total AABM LC in the commercial troll, outside tidal sport, and First Nations troll in 2016 was 99,650 Chinook salmon (Table 1.4).

Table 1.4.–Harvest of Chinook salmon by gear for West Coast Vancouver Island AABM fisheries in 2016.

WCVI Fishery	Landed Catch	Legal Releases	Sublegal Releases
Troll			
Winter	7,356	23	1,647
Spring	31,799	7	1,523
Summer	9,964	10	1,874
Food, social, and ceremonial	5,000	N/A	N/A
Maa-nulth	310	N/A	N/A
T'aaq-wiihak	6,049	25	2,777
Brooks Test Fishery	353	0	0
Troll subtotal	*60,831*	*65*	*7,821*
Sport	38,819	7,205	14,043
TOTAL	**99,650**	**7,270**	**21,864**

1.1.2.2.1 West Coast Vancouver Island Troll Fishery Catch

The AABM troll catch includes the commercial and First Nations troll caught Chinook salmon in Pacific Fishery Management Areas 21, 23–27, and 121–127. In the 2016 season (October 1, 2015 to September 30, 2016), WCVI troll fishing opportunities were consistent with a DFO commitment to evaluate winter fisheries as a means to improve the economic base for the fishery and local communities, while increasing flexibility in catch opportunities and reducing the exploitation on stocks encountered in summer fisheries (Table 1.4). Troll fishery openings were shaped by conservation concerns for Fraser River spring run age-1.2, Fraser River spring run age-1.3, Fraser River summer run age-1.3, WCVI, and Lower Strait of Georgia Chinook salmon and interior Fraser River coho salmon.

The annual WCVI commercial troll harvest was allocated by percent to the following periods: October 1 to March 15 (2%), March 16 to April 18 (Closed, 0%), April 19 to May 31 (78%), June 1 to August 5 (Closed, 0%), August 6 to September 30 (20%). A full-time closure was maintained from March 16 to April 18 to avoid interception of Fraser River spring run age 1.2. During June and until the third week of July, areas of Southwest Vancouver Island were closed to avoid Lower Strait of Georgia, Fraser River spring run age-1.2, Fraser River spring run age-1.3, and Fraser River summer run age-1.3 Chinook salmon. Full-time closures were also implemented from August 9 to September 6 in Areas 123–127 and from September 7 to 14 in Areas 123 and 124. The mandatory use of six-inch plugs, a fishery limit on coho salmon encounters, as well as time and area closures were all implemented to minimize mortality of WCVI-origin Chinook and wild coho salmon. Statistical Area 121 (Swiftsure Bank) remained closed in 2016. Selective fishing practices were mandatory, including single barbless hooks and revival tanks for resuscitating coho salmon prior to release, which affects the IM rates used for legal and sublegal Chinook. The minimum size limit for commercial troll for all periods was 55 cm (21.6 in) fork length.

From May 1 to September 30, 2016, the T'aaq-wiihak demonstration fishery, a new fishery implemented in 2012, occurred in portions of Pacific Fishery Management Areas 24 and 25, and 124–126. Fishing days were decreased during the June and July periods (as well as areas 124–126 for the months of August and September) to minimize encounters with interior Fraser River and Thompson River coho and the WCVI Chinook salmon stocks.

The catch for 2016 commercial troll fisheries was 49,119 Chinook salmon (Table 1.4). The WCVI First Nations caught an estimated 5,000 Chinook salmon in food, social, and ceremonial fisheries, 310 in the Maa-nulth Treaty catch, and 6,049 in the T'aaq-wiihak demonstration fisheries. The Brooks Test Fishery project harvested 353 Chinook salmon for samples. Therefore, the total WCVI AABM troll catch for 2016 was 60,831, with 65 legal and 7,821 sublegal Chinook salmon releases (not including releases from the WCVI food, social, and ceremonial and Maa-nulth troll fisheries, which are currently unknown).

1.1.2.2.2 West Coast Vancouver Island Sport Fishery Catch

The AABM sport fishery includes all catch in northwest WCVI (Areas 25–27, 125–127) from October 16 to June 30, and the catch outside of the surf line (about one nautical mile offshore) from July 1 to October 15, plus all the catch in southwest WCVI (Areas 21, 23, 24, 121, 123, and 124) from October 16 through July 31, and the catch outside one nautical mile offshore from

August 1 to October 15. Catch inside the surf line and outside the AABM periods specified above is included in ISBM fishery catch.

The WCVI AABM sport fishery occurs primarily in the Barkley Sound, outer Clayoquot Sound, and Nootka Sound areas. The majority of fishing effort occurs from mid-July through August in northwest Vancouver Island and August through mid-September in the Southwest Vancouver Island. Creel surveys were conducted from early June to mid-September. The Chinook salmon daily bag limit was two fish greater than 45 cm fork length (17.7 in). Barbless hooks were mandatory.

The 2016 WCVI AABM sport LC estimate during the creel period was 38,819 (Table 1.4). Catch rates were determined from anglers interviewed from June 1 to September 15. No creel surveys occurred between October and May, when effort is relatively low.

1.2 ESTIMATES OF INCIDENTAL MORTALITIES IN AABM FISHERIES

1.2.1 Southeast Alaska Fisheries

Estimates of encounters and IM in SEAK fisheries are shown for 2016 in Table 1.5 and in Appendix A for prior years. Estimates were converted from total IM into Treaty IM by multiplying the total encounters by the ratio of Treaty catch to LC for each respective fishery. The 2016 troll encounters were estimated from regressions of historical encounter estimates and troll effort. The regression predicts encounters from troll effort using encounter estimates obtained from direct fishery observation programs conducted during a series of years. The CR and CNR sublegal regressions use a data series from 1998 to 2006, while the CNR legal regression uses a data series from 1985 to 1988 and 1998 to 2006 (CTC 2011). Sport fishery releases were computed from the number of Chinook salmon caught and released as recorded on the annual Statewide Catch Survey (mail-in survey) forms. Legal and sublegal CNR purse seine encounters were calculated using a modified catch per landing approach that uses the relationship between the yearly catch and the magnitudes of legal and sublegal CNR encounters for years for which direct observational data are available (CTC 2011). For the gillnet fishery, drop-off mortality was estimated as a percentage of the LC using the region-specific drop-off rate for SEAK (CTC 2004c). Encounter estimates are multiplied by the respective IM rate from CTC (1997) to obtain estimates of IM. The estimated TM in 2016 was 408,009 nominal Treaty fish, including 353,704 LC, and 54,306 IM (Table 1.5)

Table 1.5.–Estimates of treaty and total (includes total treaty, terminal exclusion, and hatchery add-on catch and estimates of incidental mortality) landed catch (LC), incidental mortality (IM; in nominal numbers of fish), and total mortality (TM) in SEAK AABM fishery, 2016.

SEAK Fishery	LC	Legal Encounters	Sublegal Encounters	Total LIM[1]	Total SIM[1]	Total IM	Total Mortality
Treaty							
Troll CR	266,008	266,008	56,175	2,128	14,774	16,902	282,910
Troll CNR	0	35,159	23,285	7,700	6,124	13,824	13,824
Troll Total	266,008	301,167	79,459	9,828	20,898	30,726	296,734
Sport Total[2]	62,490	93,800	49,398	7,228	7,854	15,082	77,572
Gillnet	4,921	4,921	0	98	0	98	5,020
Seine CR	20,285	20,285	9,790	0	8,400	8,400	28,684
Seine CNR	0	0	0	0	0	0	0
Net Total	25,206	25,206	9,790	98	8,400	8,498	33,704
Treaty Total	**353,704**	**420,173**	**138,647**	**17,154**	**37,152**	**54,306**	**408,009**
Total SEAK							
Troll CR	276,432	276,432	58,376	2,211	15,353	17,564	293,996
Troll CNR	0	35,477	23,495	7,769	6,179	13,949	13,949
Troll Total	276,432	311,909	81,871	9,981	21,532	31,513	307,945
Sport Total[2]	70,777	106,240	55,949	8,187	8,896	17,082	87,859
Gillnet	14,019	14,019	0	280	0	280	14,299
Seine CR	28,244	28,244	13,631	0	11,695	11,695	39,939
Seine CNR	0	0	0	0	0	0	0
Net Total	42,263	42,263	13,631	280	11,695	11,976	75,590
SEAK Total	**389,472**	**469,084**	**174,482**	**18,448**	**42,123**	**60,571**	**471,395**

[1] Includes dropoff mortality. LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[2] Catch data are preliminary estimates from creel survey expansions; IM for the SEAK sport fishery is estimated from the preliminary LC and the previous year IM to LC ratios. Final estimates are available from mail-out surveys in October one year post fishing season and will be reported in Table A2 and Table A3 of the next annual Catch and Escapement Report.

1.2.2 British Columbia Fisheries

1.2.2.1 Northern British Columbia Fisheries

Table 1.6 summarizes estimates of LC, encounters and associated IM by size class during CR and CNR fishing periods for the 2016 NBC AABM fishery. Releases of Chinook salmon from the NBC troll fishery are based on logbook data. Encounters from the QCI sport fishery are based on creel survey and logbook programs. IM estimates were derived using gear- and size-specific rates from the CTC (1997). The estimated TM for 2016 was 204,317 nominal fish, which included 190,181 LC, and 14,136 IM.

1.2.2.2 West Coast Vancouver Island Fisheries

The estimated TM of Chinook salmon for the 2016 WCVI AABM fishery was 109,044 nominal fish, which included 99,650 LC and 9,394 IM (Table 1.6). The estimated IM included 5,109 legal and 4,285 sublegal nominal Chinook salmon (Table 1.6). Table 1.6 also summarizes encounters for these fisheries by size class during CR and CNR fisheries.

Table 1.6.–Estimates of total landed catch (LC), incidental mortality (IM; in nominal numbers of fish), and total mortality (TM) in NBC and WCVI AABM fisheries, 2016.

Fishery	LC	Legal Releases	Sublegal Releases	LIM[1] Drop-off	Total LIM[1]	Total SIM[1]	Total IM	Total Mortality
NBC								
Troll CR	147,381	1,510	21,353	2,505	2,810	5,061	7,871	155,252
Troll CNR	0	0	0	0	0	0	-	-
Troll Total	147,381	1,510	21,353	2,505	2,810	5,061	7,871	155,252
Sport Total	42,800	29,711	0	1,541	6,265	0	6,265	49,065
NBC Total	190,181	31,221	21,353	4,046	9,075	5,061	14,136	204,317
WCVI								
Troll CR	49,472	40	5,043	841	849	1,195	2,044	51,516
Troll CNR	0	0	0	0		0		0
First Nations Troll[2]	0	0	0	0	0	0	-	-
First Nations EO Troll[3]	11,359	25	2,777	193	198	394	592	11,951
Troll Total	60,831	65	7,820	1,034	1,047	1,589	2,636	63,467
Sport Total	38,819	7,205	14,043	2,679	4,062	2,696	6,758	45,577
WCVI Total	99,650	7,270	21,863	3,713	5,109	4,285	9,394	109,044

[1] LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[2] First Nations troll includes food, social, and ceremonial and Maa-nulth Treaty catch.

[3] First Nations economic opportunity (EO) Troll is the T'aaq-wiihak fishery.

1.3 REVIEW OF INDIVIDUAL STOCK BASED MANAGEMENT FISHERIES

ISBM fisheries include all British Columbia Chinook salmon fisheries that are not included in the NBC and WCVI AABM fisheries, and all marine and freshwater Chinook salmon fisheries in Washington and Oregon. ISBM fisheries are managed with the intent of meeting management objectives for individual stocks listed in Attachments IV and V in Chapter 3, Annex IV, of the PST.

1.3.1 Canadian Individual Stock Based Management Fisheries

The Canadian ISBM fisheries include all fisheries that catch or release Chinook salmon in British Columbia that are not AABM fisheries. Catches of Taku River and Stikine River Chinook salmon occurring in Canada are also provided, although provisions for catch sharing arrangements between Canada and the US for these two Transboundary River stocks are described in Chapter 1 of the 2009 Agreement. ISBM obligations are not applicable to these stocks since they are not identified in the Attachments to Chapter 3. In 2016, a total of 181,960 nominal fish were caught in Canadian ISBM fisheries in British Columbia and Canadian sections of the Transboundary Rivers. Total estimated IM in 2016 was 19,409 legal and 20,334 sublegal Chinook salmon. The distribution of LC and estimated IM are presented in Table 1.7.

Table 1.7.–Landed catch and incidental mortalities in Canadian ISBM fisheries for 2016.

Region/Gear	Landed Catch	Release Legals	Release Sublegals	Total LIM[1]	Total SIM[1]	Total Mortality
Transboundary Rivers	4,895			226	0	5,121
Net	4,149			191	0	4,340
Freshwater Sport	20			1	0	21
First Nations-FSC[2]	726			33	0	759
Northern British Columbia	22,954	4,262	147	3,045	106	26,105
Net	1,222	2,072	147	1,746	106	3,073
Tidal Sport	10,043	2,190	0	710	0	10,753
Freshwater Sport	2,246	0	0	155	0	2,401
First Nations-FSC	9,051	0	0	416	0	9,467
Tyee Test Fishery	392			18	0	410
Central British Columbia	12,366	986	411	1,101	296	13,763
Net	3,192	639	411	635	296	4,123
Tidal Sport	5,769	60	0	217	0	5,986
Freshwater Sport	1,493	0	0	103	0	1,596
First Nations-FSC	1,912	0	0	88	0	2,000
Troll	0	287	0	58	0	58
West Coast Vancouver Island	45,453	3,982	24,608	3,834	4,931	54,217
Net	5,125	535	390	632	281	6,038
Tidal Sport	26,237	3,447	24,218	2,472	4,650	33,359
First Nations-EO[3]	10,565	0	0	486	0	11,051
First Nations-FSC	3,526	0	0	243	0	3,769
Johnstone Strait	9,081	977	6,337	816	1,217	11,114
Net	0	14	1	13	1	13
Tidal Sport	8,734	963	6,336	788	1,217	10,738
First Nations-FSC	347	0	0	16	0	363
Georgia Strait	44,151	3,619	54,658	3,797	10,513	58,461
Net	3	101	35	90	25	118
Tidal Sport	43,498	3,476	54,623	3,669	10,488	57,654
First Nations-FSC	650	0	0	30	0	680
Troll	0	42	0	8	0	8
Juan de Fuca	22,965	8,405	16,714	3,819	3,272	30,055
Net	0	1,173	83	846	79	924
Tidal Sport	22,965	7,232	16,631	2,973	3,193	29,131
Fraser River	20,095	5,929		2,772	0	22,867
Commercial Net	2,292	373		458	0	2,750
First Nations-EO Net	0			0	0	0
First Nations-FSC Net	10,291	338		793	0	11,084
Mainstem Catch Sport	1,826	35		133	0	1,959
Test Fishery Net				0	0	0
Trib Catch Sport	5,686	5,183		1,387	0	7,073
Grand Total	**181,960**	**28,160**	**102,875**	**19,409**	**20,334**	**221,703**

[1] LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[2] FSC = food, social, and ceremonial.

[3] EO = economic opportunity.

1.3.2 Southern US Individual Stock Based Management Fisheries

Southern US fisheries of interest to the PSC, generally those north of Cape Falcon, Oregon, are managed in accordance with legal obligations stemming from treaties between Indian tribes and the US, and where relevant, the conservation constraints set by the ESA. In 1974, *US v. Washington* set forth sharing obligations to meet treaty fishing rights in western Washington. Treaty rights of Columbia River tribes were defined by *US v. Oregon*, and the Columbia River Fisheries Management Plan was implemented in 1977. In reporting, these fisheries are termed *treaty Indian* if they are fishing under the Native American Treaty fishing rights and *non-Indian* otherwise. Currently, all southern US fisheries are ISBM fisheries (Table 1.8). Historical catches in these fisheries are provided in Table A16 through Table A22.

Table 1.8.–Landed catch and incidental mortality in Southern US troll, net, and sport fisheries, 2014–2016.

		2016[1]			2015			2014		
Fishery	**Gear**	**LC**	**Release**	**IM**	**LC**	**Release**	**IM**	**LC**	**Release**	**IM**
Juan de Fuca	Net	248	NA	20	831	NA	66	1,314	NA	105
	Sport	12,590	34,845	11,164	11,810	32,687	10,473	11,059	26,877	8,807
	Troll	578	NA	14	4,876	NA	122	4,512	NA	113
Total		**13,416**	**34,845**	**11,198**	**17,517**	**32,687**	**10,661**	**16,885**	**26,877**	**9,025**
San Juans	Net	22	0	2	4,773	7,928	6,724	6,826	5,711	5,115
	Sport	9,104	12,633	4,706	8,593	11,925	4,442	9,216	9,075	3,768
Total		**9,126**	**12,633**	**4,708**	**13,366**	**19,853**	**11,166**	**16,042**	**14,786**	**8,883**
Puget Sound	Net	79,251	NA	6,340	58,162	NA	4,653	50,767	NA	4,061
	Sport	26,743	50,282	17,353	20,050	99,807	29,656	23,903	44,942	15,510
Total		**105,994**	**50,282**	**23,693**	**78,212**	**99,807**	**34,308**	**74,670**	**44,942**	**19,572**
Wash. Inside Coastal	Net	14,135	NA	283	32,760	NA	655	39,514	NA	790
	Sport	14,180	NA	978	22,612	NA	1,560	9,740	NA	672
Total		**28,315**	**NA**	**1,261**	**55,372**	**NA**	**2,215**	**49,254**	**NA**	**1,462**
Columbia River--Spring	Net	35,021	2,101	1,639	61,084	3738	2,879	47,030	2,182	2,022
	Sport	55,421	4,649	4,749	87,006	5,935	7,184	59,242	8,250	5,729
Summer	Net	24,223	0	727	42,090	0	1,263	22,377	-	671
	Sport	11,818	8,650	1,879	22,291	1,629	1,738	8,300	11,366	1,971
Fall	Net	206,484	0	6,195	358,514	0	10,755	387,321	-	11,620
	Sport	79,312	8,053	7,019	143,927	27,121	15,138	117,313	25,295	12,951
Total		**412,279**	**23,453**	**22,207**	**714,912**	**38,423**	**38,958**	**641,583**	**47,093**	**34,963**
WA/OR North Falcon	Sport	17,948	21,133	3,654	42,179	18,983	3,986	42,327	34,056	6,251
	Troll	42,234	NA	1,056	125,384	NA	3,135	116,489	NA	2,912
Total		**60,182**	**21,133**	**4,710**	**167,563**	**18,983**	**7,121**	**158,816**	**34,056**	**9,163**
Oregon Inside	Sport[2]	49,652	NA	3,426	69,790	NA	4,816	46,919	NA	3,237
	Troll[3]	182	NA	5	1,164	NA	29	847	NA	21
Total		**49,834**	0	**3,431**	**70,954**	0	**4,845**	**47,766**	-	**3,259**
GRAND TOTAL		**679,146**	**142,346**	**71,208**	**1,117,896**	**209,754**	**109,274**	**1,005,016**	**167,754**	**86,327**

Note: NA = Not available.

[1] Washington Department of Fish and Wildlife Catch Record Card estimates of LC were not yet available; LC and releases for 2016 were computed using 2013–2015 mean values.

[2] Values for 2016 LC and IM are estimates based on averages, not actual observed values. These will become available after the timeframe required for this report.

[3] The value represented by Troll is the concentrated fishery off of the mouth of the Elk River which is designed to specifically exploit returning Elk River Chinook salmon.

1.3.2.1 Strait of Juan de Fuca and the San Juan Islands

The preliminary estimate of the 2016 Chinook salmon catch in Strait of Juan de Fuca (Area 4B, 5, 6, and 6C) net fisheries was 248 fish with the majority of these taken during fisheries targeting Fraser River sockeye salmon. There were 22 Chinook salmon harvested in the San Juan Islands net fisheries (Area 6A, 7, and 7A). The preliminary estimate of the 2016 Strait of Juan de Fuca treaty Indian troll fishery catch (through December 2016) is 578 Chinook salmon. The catch estimate does not include catches from Area 4B during the May to September Pacific Fisheries Management Council management period. Historic catch estimates are provided for the Strait of Juan de Fuca (Table A16) and San Juan areas (Table A17).

1.3.2.2 Puget Sound

The preliminary estimate of the net fishery harvest of Chinook salmon in Puget Sound marine and freshwater areas (excluding Strait of Juan de Fuca and the San Juan Islands) in 2016 is 79,251 (72,648 treaty Indian, 6,603 non-Indian). The harvests in treaty Indian fisheries include a preliminary estimate of 24,124 Chinook salmon in in-river fisheries. Estimates of the sport catch in 2016 are not yet available from the Washington Department of Fish and Wildlife (WDFW) Catch Record Card accounting system; thus, the preliminary estimate of sport catch reported here for 2016 is an average of the previous three years (26,743). Historic catch tables for Puget Sound (exclusive of the Strait of Juan de Fuca and San Juan Islands) are provided in Table A18.

1.3.2.3 Washington Coast Terminal

The preliminary 2016 estimate of harvest in Washington coastal net fisheries was 14,135 Chinook salmon. Harvest in treaty Indian fisheries include 8,888 harvested in north coastal rivers (Quinault, Queets, Hoh, and Quillayute rivers) and 2,077 in Grays Harbor and the Humptulips and Chehalis rivers within the basin. The 2016 non-Indian commercial net harvest was 26 Chinook salmon in Grays Harbor and 3,144 from Willapa Bay.

From Grays Harbor north, sport fisheries were implemented based upon preseason state–tribal agreements and were subject to inseason adjustment. Estimates of sport fishery catches for Washington coastal terminal fishing areas in 2016 are not yet available from the Catch Record Card accounting system, but are approximated here based on the average catch from the previous three years. Historic catch estimates for Washington Coastal inside fisheries are shown in Table A19.

1.3.2.4 North of Cape Falcon

Ocean fisheries off the coasts of Washington, Oregon, and California are managed under regulations recommended by the Pacific Fishery Management Council. The fisheries north of Cape Falcon also fall under the jurisdiction of the PST. For 2016, the estimated catch of Chinook salmon in commercial troll fisheries from Cape Falcon, Oregon, to the US-Canada border was 42,234 for non-Indian and treaty Indian fisheries combined. Estimated catch in the ocean sport fishery north of Cape Falcon in 2016 was 17,948 Chinook salmon. Historic catch estimates for US ocean fisheries north of Cape Falcon are shown in Table A20.

1.3.2.5 Columbia River

Chinook salmon from the Columbia River are divided into eight stock groups for management purposes. These groups are delineated by run timing and area of origin: (1) spring run originating below Bonneville Dam, (2) spring run originating above Bonneville Dam, (3) summer run originating above Bonneville Dam, (4) fall run returning to Spring Creek Hatchery, (5) fall run originating in hatchery complexes below Bonneville Dam, (6) wild fall run originating below Bonneville Dam, (7) Upriver Bright fall run, and (8) Mid-Columbia Bright fall hatchery fish.

When comparing the IM estimates in Table 1.8 and Table A21 with IM from *US v. Oregon* Technical Advisory Committee, WDFW, Oregon Department of Fish and Wildlife (ODFW), and Columbia River Intertribal Fish Commission (CRITFC) reports, readers should keep the following in mind.

(1) The Columbia River fishery management agencies include release mortality in some of their catch estimates whereas the tables in this report show LC in terms of retained fish only.

(2) Release mortality rates used by Columbia River fishery management agencies differ from those used by the CTC for this report.

(3) The tables in this report include estimates of IM from net dropout and hook and line dropoff, whereas the Columbia River fishery management agencies do not estimate this type of fishery related mortality.

In 2016, the total annual harvest for all fisheries (spring, summer, and fall, both hatchery and wild) in the Columbia River basin was 412,279 Chinook salmon. This included non-Indian commercial net plus Wanapum and Colville tribal harvest of 84,698; sport harvest of 146,551; and treaty Indian commercial, ceremonial, and subsistence harvest of 181,030 (Table A21). The 2016 total annual Columbia River combined net and sport harvest consisted of 90,442 spring Chinook, 36,041 summer Chinook and 412,279 fall Chinook salmon (Table 1.8).

1.3.2.6 Oregon Coast Terminal

Most harvest in ocean fisheries off Oregon's coast is comprised of a mixture of southern Oregon and California Chinook salmon stocks not included in the PSC agreement. These stocks usually do not migrate north into the PSC jurisdiction to any great extent. Chinook salmon originating from Oregon streams north of Cape Blanco migrate north, and a majority of these populations are designated as the North Oregon Coast (NOC) aggregate and are included in the CTC Chinook model. On the mid-Oregon coast south of the NOC to north of Cape Blanco is a smaller population group designated as Mid-Oregon Coastal (MOC) aggregate populations. The NOC stocks are harvested only incidentally in Oregon ocean fisheries, while the contribution of MOC stocks to Oregon and Washington ocean fisheries is greater (based on CWT distribution data). Catch statistics for MOC are readily available for only one terminal ocean area troll fishery on a hatchery supplemented stock at the mouth of the Elk River. Late season (October to December) troll catch in the Elk River terminal troll fishery in 2016 was 182 Chinook salmon.

Sport catch of these two stock groups occurs primarily in estuary and freshwater areas as mature fish return to spawn, and catch is reported through a punch card accounting system. These estimates become available more than two years after the current season. Therefore, inriver and estuary sport catch punch card estimates are only provided through 2015 for the NOC. The 2015 punch card estimate of estuary and freshwater catch for the NOC group is 69,790 Chinook salmon. However, catch projections have been made for 2016 using correlations between escapement and punch card catch estimates from past years; these preliminary estimates of terminal sport catch for 2016 are presented in Table 1.9. Historical catch estimates for the troll fishery targeting Elk River and the estuary and freshwater sport fisheries targeting on NOC stocks are shown in Table A22.

1.3.3 Estimates of Incidental Mortality for Southern US Fisheries

Table 1.8 shows estimates of IMs for southern US fisheries in marine and river fisheries in Puget Sound, on the Washington and Oregon coast north of Cape Falcon, Oregon coast terminal fisheries, and in the Columbia River fisheries. IM was calculated using the release mortality, drop-out, and drop-off mortality rates assigned for areas and gears in CTC (1997). Number of fish released is from creel interviews, voluntary trip reports, fishery monitoring, or extrapolated from similarly structured fisheries with known release information.

1.4 SUMMARY OF 2016 COASTWIDE LANDED CATCH, INCIDENTAL MORTALITY, AND TOTAL MORTALITY IN PSC FISHERIES

Table 1.10 provides a coastwide summary of Chinook salmon catches and estimates of IM and TM in PST fisheries for 2016. It should be noted, for some component fisheries, that current 2016 LC and IM are not yet available; the preliminary estimates of LC and IM will be updated in future reports as observed data become available.

The preliminary estimate of Treaty LC of Chinook salmon for all PST fisheries in 2016 is 1,504,640, of which 1,032,849 were taken in US fisheries and 471,791 were taken in Canadian fisheries (Table 1.9). Total estimated IM associated with this harvest is 188,383 nominal Chinook salmon (11% of the TM) in nominal fish. The TM for all PST fisheries in nominal fish was 1,693,023 Chinook salmon, which is approximately 551,800 less than recorded for 2015 (Table A25). Of the 1,693,023 total PSC TM estimated for 2016, 1,158,363 occurred in US fisheries and 534,660 occurred in Canadian fisheries. For US fisheries, 66% of the LC and 57% of IM occurred in ISBM fisheries; in Canada, 39% of the LC and 63% of IM occurred in ISBM fisheries. For some component sport fisheries, 2016 LC and IM estimates are not yet available. Data for calculating summary information contained in Table 1.10 for 2016 and previous years can be found in Table A23, Table A24, and Table A25.

Table 1.9.–Summary in nominal fish of preliminary estimates for landed catch (LC), incidental mortality (IM), and total mortality (TM) for US and Canada AABM and ISBM fisheries in 2016.

	2016		
Fishery	**LC**	**IM**	**TM**
SEAK AABM	353,704	54,306	408,009
SEAK hatchery add-on and terminal exclusion	35,768	6,265	42,034
US ISBM	679,146	71,208	750,354
US TOTAL[1]	1,032,849	125,514	1,158,363
NBC AABM	190,181	14,136	204,317
WCVI AABM	99,650	9,394	109,044
CANADA ISBM	181,960	39,339	221,299
CANADA TOTAL	471,791	62,869	534,660
PST FISHERIES TOTAL[1]	1,504,640	188,383	1,693,023

[1] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

2. CHINOOK SALMON ESCAPEMENTS

The 2009 PST Agreement (Annex IV, Chapter 3, Paragraph 2.a.ii) establishes a Chinook salmon fishery management program that

> *continues harvest regimes based on annual estimates of abundance that are responsive to changes in production, take into account all fishery induced mortalities and designed to meet MSY or other agreed biologically-based escapement and/or harvest rate objectives; with the understanding that harvest rate management is designed to provide a desired range of escapements over time; ...*

The CTC compares annual estimates of escapement indicators that have MSY or other agreed biologically-based escapement goals established for Chinook salmon stocks. The CTC has accepted escapement goals for 22 stocks included in this report. Escapement goals reviewed by the CTC are based on analyses that follow the guidelines developed in the CTC escapement goal report (CTC 1999).Table 2.1 lists the PSC Chinook fisheries management regime, the applicable stock group in Attachments I-V, the represented region, CTC escapement indicator, and run timing of the indicator stock.

The Agreement (Annex IV, Chapter 3, Paragraph 2.b.iii) directs the CTC to

> *report annually on the escapement of naturally spawning Chinook salmon stocks in relation to the agreed escapement objectives ..., evaluate trends in the status of stocks, and report on progress in the rebuilding of naturally spawning Chinook salmon stocks...*

The escapement goals and 2015–2016 escapements for those 22 stocks are listed in Table 2.2. For eight of these stocks, the escapement goal is defined as a range; for the remaining 14 stocks, the escapement goal is defined as a point estimate. In 2016, escapements were above the goal for 13 stocks and below the goal for 9 stocks.

This annual report includes a brief assessment of all indictor stock escapement estimates from 1999 to 2016 showing the number of stocks with PSC accepted escapement goals achieving or falling below goals (Figure 2.1). Section 2.2 provides escapement trends grouped into five regions: Southeast Alaska, Transboundary, British Columbia, Washington, and Columbia River-Oregon, and stock-specific assessments within those regions. In Section 3.3, a framework is used for escapement assessments with narratives and graphs for each stock that include a description of escapement methodology, escapement goal basis, and agency comments.

Table 2.1.–Pacific Salmon Commission Chinook salmon escapement indicator stocks.

Presence in Treaty Attachments[1]								
SEAK	NBC/ QCI	WCVI	BC ISBM	SUS ISBM	Stock Group in Attachment I–V	Escapement Indicator	Region[1]	Run
						Situk	Yakutat	Spring
						Chilkat	N. Inside	Spring
						Unuk	S. Inside	Spring
						Chickamin	S. Inside	Spring
						Alsek	TBR	Spring
						Taku	TBR	Spring
						Stikine	TBR	Spring
✓	✓		✓		North/Central British Columbia	Yakoun	NBC-Area 1	Summer
✓	✓		✓		North/Central British Columbia	Nass	NBC-Area 3	Spring/Summer
✓	✓		✓		North/Central British Columbia	Skeena	NBC-Area 4	Spring/Summer
			✓		North/Central British Columbia	Dean	CBC-Area 8	Spring
						Rivers Inlet	CBC-Area 9	Spring/Summer
✓	✓		✓		WCVI Falls	Artlish, Burman, Kaouk, Tahsis, Tashish, Marble	WCVI	Fall
✓	✓		✓		UGS	Klinaklini , Kakwiekan, Wakeman, Kingcome, Nimpkish	UGS	Summer/Fall
			✓		LGS	Cowichan/Nanaimo[2]	LGS	Fall
✓	✓		✓		Fraser Early[3] (Spr/Sum)	Fraser Spring 1.3	FR	Spring
✓	✓		✓		Fraser Early[3] (Spr/Sum)	Fraser Spring 1.2	FR	Spring
✓	✓		✓		Fraser Early[3] (Spr/Sum)	Fraser Summer 1.3	FR	Summer
✓	✓		✓		Fraser Early[3] (Spr/Sum)	Fraser Summer 0.3	FR	Summer
		✓	✓	✓	Fraser Late	Harrison	FR	Fall
			✓	✓	North Puget Sound Natural springs	Nooksack	NC/PS	Spring
			✓	✓	North Puget Sound Natural Springs	Skagit Spring	NC/PS	Spring
		✓	✓	✓	Puget Sound Natural Summer/Falls	Skagit Summer/Fall	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Stillaguamish	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Snohomish	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Lake Washington	NC/PS	Summer/Fall
		✓	✓	✓	Puget Sound Natural Summer/Falls	Green	NC/PS	Summer/Fall
✓	✓			✓	Washington Coastal Fall Natural	Hoko	WAC/JDF	Fall
						Quillayute Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Quillayute Fall	WAC/JDF	Fall

–continued–

Table 2.1.–Page 2 of 2.

Presence in Treaty Attachments[1]								
SEAK	NBC/ QCI	WCVI	BC ISBM	SUS ISBM	Stock Group in Attachment I–V	Escapement Indicator	Region[1]	Run
						Hoh Spring/Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Hoh Fall	WAC/JDF	Fall
						Queets Spring/Summer	WAC/JDF	Summer
✓	✓			✓	Washington Coastal Fall Natural	Queets Fall	WAC/JDF	Fall
						Grays Harbor Spring	WAC/JDF	Spring
✓	✓			✓	Washington Coastal Fall Natural	Grays Harbor Fall[4]	WAC/JDF	Fall
						Columbia Upriver Spring	COLR	Spring
✓	✓	✓		✓	Columbia River Upriver Summers	Mid-Columbia Summers	COLR	Summer
✓	✓	✓		✓	Columbia River Falls	Upriver Brights	COLR	Fall
✓	✓	✓		✓	Columbia River Falls	Lewis	COLR	Fall
✓	✓	✓		✓	Columbia River Falls	Deschutes	COLR	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Nehalem	NOC	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Siletz	NOC	Fall
✓	✓			✓	Far North Migrating Oregon Coastal	Siuslaw	NOC	Fall
						South Umpqua	MOC	Fall
						Coquille	MOC	Fall

Note: Shading indicates that there is not a CTC-accepted escapement goal.

[1] Refer to List of Acronyms for definitions.

[2] An escapement goal was established for the Cowichan in 2005; a goal for Nanaimo is still pending.

[3] The escapement indicator stocks listed in the Annex tables for this group are Upper Fraser, Middle Fraser, and Thompson. The Fraser River spring/summer group is split into these four escapement indicators to represent the stock group by life history type rather than geographically.

[4] An escapement goal for Grays Harbor fall was accepted by the CTC in February, 2014.

Table 2.2.–Escapement goals, 2015–2016 escapements, and 2017 forecasts for stocks with CTC-accepted goals.

Stock	Region[1]	Stock Group	Escapement Goal	2015 Escapement[2]	2016 Escapement[2]	2017 Forecast[2]
Situk[3]	SEAK	Yakutat	500–1,000	**174 (35%)**	**329 (66%)**	475 (95%)
Chilkat[3]	SEAK	Northern Inside	1,750–3,500	2,456 (140%)	**1,386 (79%)**	**634 (36%)**
Unuk[3]	SEAK	Southern Inside	1,800–3,800	2,623 (146%)	**1,463 (81%)**	**1,500 (83%)**
Chickamin	SEAK	Southern Inside	2,150–4,300	2,693 (125%)	**964 (45%)**	NA
Alsek	TBR	Transboundary Rivers	3,500–5,300	5,697 (163%)	**2,574 (74%)**	NA
Taku[4]	TBR	Transboundary Rivers	19,000–36,000	28,850 (152%)	**12,381 (65%)**	**13,300 (70%)**
Stikine[4]	TBR	Transboundary Rivers	14,000–28,000	21,343 (152%)	**10,343 (74%)**	18,300 (131%)
Harrison	BC	Fraser River	75,100–98,500	101,516 (135%)	**41,327 (55%)**	64,476 (86%)
Cowichan	BC	Lower Strait of Georgia	6,500	**5,984 (92%)**	7,787 (177%)	NA
Quillayute Fall[4]	WAC	Washington Coast	3,000	3,440 (115%)	3,654 (122%)	6,433 (214%)
Queets Spr/Sum[4]	WAC	Washington Coast	700	**532 (76%)**	704 (101%)	**536 (77%)**
Queets Fall[4]	WAC	Washington Coast	2,500	5,313 (213%)	2,915 (117%)	3,692 (148%)
Hoh Spr/Sum[4]	WAC	Washington Coast	900	1,080 (120%)	1,241 (138%)	1,000 (111%)
Hoh Fall[4]	WAC	Washington Coast	1,200	1,795 (150%)	2,831 (236%)	2,725 (227%)
Grays Harbor Fall[4]	WAC	Washington Coast	13,326	22,200 (167%)	**11,685 (87%)**	16,192 (120%)
Mid-Columbia Summers[5]	COLR	Columbia River Summers	12,143	88,691 (730%)	79,253 (653%)	54,900 (452%)
Upriver Brights[5]	COLR	Columbia River Falls	40,000	385,774 (964%)	189,358 (473%)	121,100 (303%)
Deschutes Fall	COLR	Columbia River Falls	4,532	17,074 (377%)	11,628 (257%)	14,316 (316%)
Lewis[5]	COLR	Columbia River Falls	5,700	23,631 (415%)	8,957 (157%)	8,600 (151%)
Nehalem	ORC	Oregon Coast	6,989	12,678 (181%)	10,074 (144%)	8,107 (116%)
Siletz	ORC	Oregon Coast	2,944	6,397 (216%)	8,479 (288%)	8,348 (284%)
Siuslaw	ORC	Oregon Coast	12,925	35,087 (271%)	30,135 (233%)	19,392 (150%)

[1] Refer to List of Acronyms for definitions.

[2] Percentages relative to the point goal or the lower end of the range are in parentheses. Escapements below the goal or lower bound of the escapement range are shaded; escapements or forecasts below the 85% threshold applicable to Attachment I–III are bold.

[3] The forecasts for Situk and Unuk Chinook salmon are for total run and Chilkat Chinook salmon is for inriver run; these are not forecasts of escapement.

[4] Forecasts for are for terminal run and are not forecasts of escapement.

[5] Projected escapement in 2017 is based on applying 2016 post season escapement rate (i.e., observed escapement divided by terminal run) to the 2017 terminal run forecast.

2.1 ESCAPEMENT GOAL ASSESSMENTS

The CTC has now assessed the status of stocks with CTC-accepted goals for return years 1999 through 2016. The number of stocks with CTC-accepted goals has increased from 15 to 22 (Figure 2.1) and the percentage of stocks that met or exceeded escapement goals or goal ranges has varied between 50% and 96%. In 2016, the percentage of stocks that met or exceeded goal was 59%. Of the 9 stocks below goal, one stock (Grays Harbor Fall) was within 15% of the target goal and 8 stocks were more than 15% below goal: Situk, Chilkat, Unuk, Chickamin, Alsek, Taku, Stikine, and Harrison.

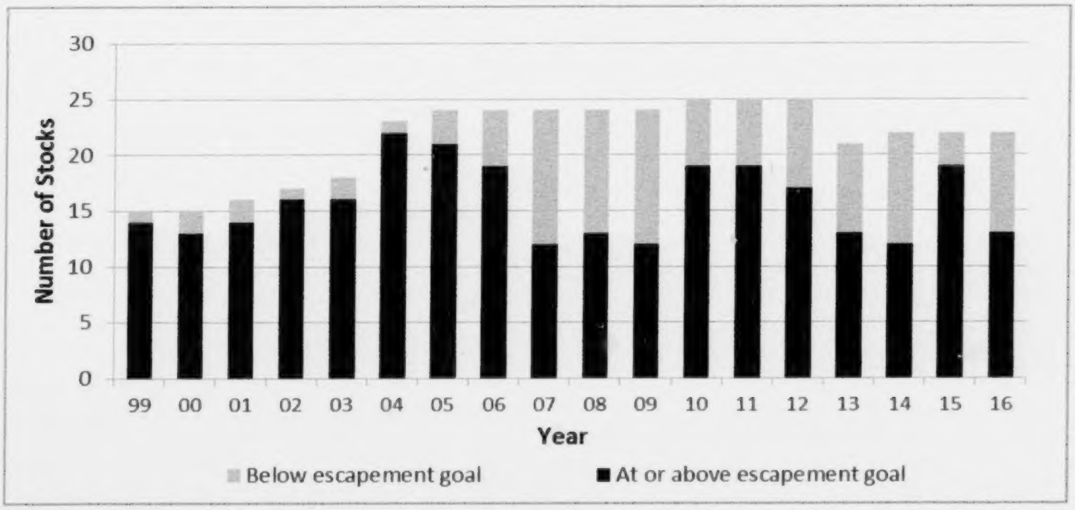


Figure 2.1.–Number and status of stocks with CTC-accepted escapement goals, 1999–2016.

Note: The Keta, Blossom, and King Salmon rivers and Andrews Creek stocks were dropped as escapement indicator stocks in 2013 and Grays Harbor fall was added in 2014, bringing the total number of current indicator stocks with CTC-accepted escapement goals to 22 since 2014.

2.2 TRENDS FOR ESCAPEMENT INDICATOR STOCKS

The evaluation of escapement trends in Chinook salmon is based on the 1999 to 2016 time series of escapement using a state-space exponential growth model (Dennis et al. 2006) parameterized through restricted maximum likelihood (Humbert et al. 2009), which estimates rates of change that are generally superior to those produced through maximum likelihood (Staples et al. 2004). Assuming the true population is generated by stochastic exponential growth, this method separates observation error and process noise and produces variances and confidence intervals (CIs) that fully represent the annual variability associated with environmental stochasticity and sampling or observation error (Humbert et al. 2009). The start year corresponding with the 1999 Agreement was used; however, CIs would improve with a longer time series (Humbert et al. 2009). For some stocks, the time series is shorter due to changes in escapement sampling methodology, so trends are based on estimates using the same methodology. Stock-specific escapement trends are characterized by the long-term mean rate of change (μ) and corresponding 80% CIs, where μ = 0.00 indicates that escapement has been stable on average for the selected time period. If the ratio of process noise and observation error is constant, the CIs represent the inter-annual variability in escapement rates of change (Humbert et al. 2009). Stocks are grouped into five regions: Southeast Alaska, Transboundary, British Columbia, Washington, and Columbia River-Oregon.

2.2.1 Escapement Trends for Southeast Alaska Stocks

Escapement trends for 1999–2016 showed that three of four SEAK stocks of Chinook salmon (Chilkat, Chickamin, Unuk) demonstrated variable trends and were not significantly different from zero (Figure 2.2). Escapements have declined significantly for the Situk stock. Poor productivity associated with SEAK Chinook salmon and especially with outside-rearing stocks started with the 2002 brood year and was manifested in the 2008 return year; this has led to some escapements less than goal for the Situk stock.

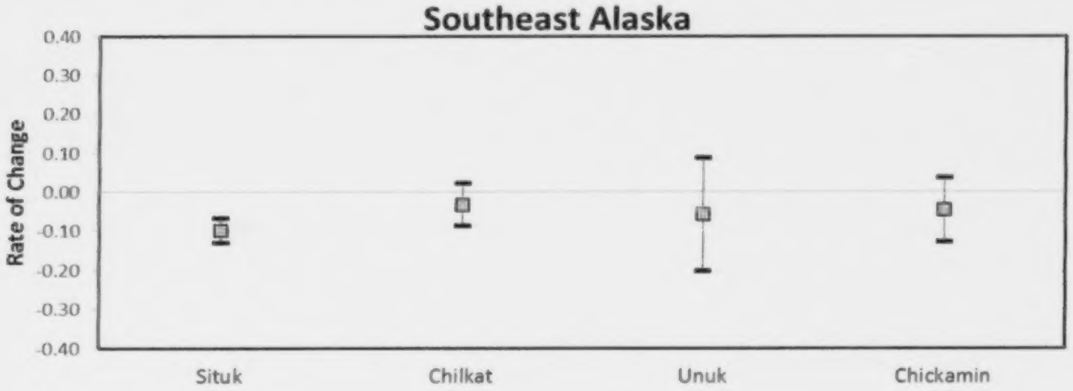


Figure 2.2.–Long-term annual rates of change in escapements for SEAK Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. All of these stocks have CTC-accepted escapement goals.

2.2.2 Escapement Trends for Transboundary Stocks

Escapement trends for 1999–2016 showed that all three TBR stocks of Chinook salmon (Alsek, Taku, and Stikine) demonstrated variable trends and were not significantly different from zero (Figure 2.3).

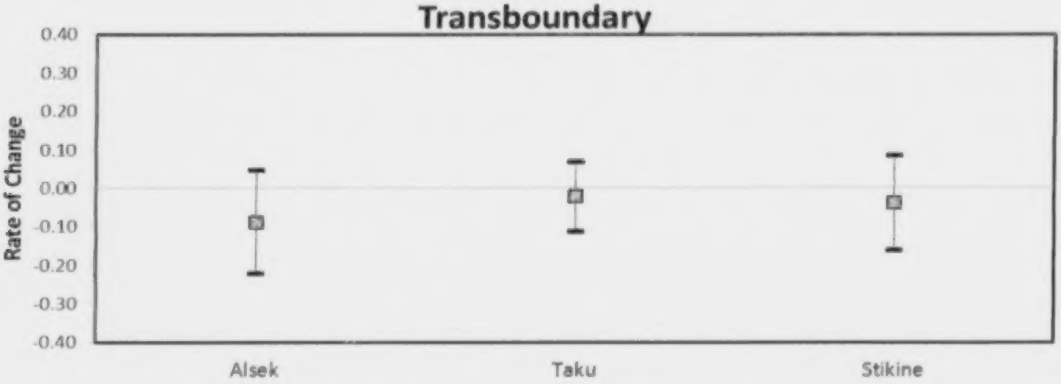


Figure 2.3.–Long-term annual rates of change in escapements for TBR Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. All of these stocks have CTC-accepted escapement goals.

2.2.3 Escapement Trends for Canadian Stocks

Rates of change for Canadian stocks were based on the 1999–2016 time series of escapement for 15 of the 17 stocks evaluated. Escapement time series for Lower Shuswap started in 2000 due to changes in escapement estimation methodologies the time series for Chuckwalla-Kilbella ended in 2015 because an escapement estimate was not produced for 2016. Few Canadian stocks exhibited clearly positive or negative tendencies in long-term rates of change in escapement due to large variability in annual rates of change (Figure 2.4). Eight stocks showed negative mean rates of change, but only Harrison, which has a CTC-agreed escapement goal, showed a clear negative trend. Stocks that showed a positive long-term rate of change in escapement include Fraser Summer 0.3, Wannock, and marginally WCVI 6-Stream Index. Chinook salmon from Fraser Summer 0.3, Harrison, Nanaimo, and Wannock exhibited the lowest variability in annual rates of change in escapement whereas Chinook salmon from Chuckwalla-Kilbella, Fraser Summer 1.3, and Nicola exhibited the largest variability amongst all Canadian stocks. The highest annual long-term mean rate of change in escapement for a Canadian stock was 6.7% for Chinook salmon from the Wannock River, and the lowest mean rate of change in escapement was –12.1% for Chinook salmon from the Chuckwalla-Kilbella aggregate.

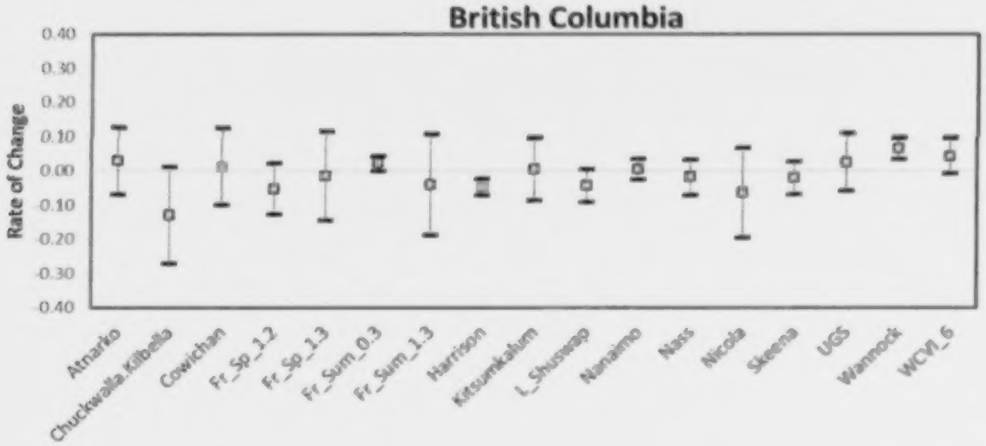


Figure 2.4.–Long-term annual rates of change in escapements for Canadian Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals, grey colored squares indicate the stocks do not have CTC-accepted escapement goals. Escapement time series for Nanaimo started in 2005 due to changes in escapement estimation methodologies.

2.2.4 Escapement Trends for Washington Stocks

Escapement trends for 1999–2016 revealed several noteworthy patterns for Puget Sound and Washington Coastal escapement indicator stocks (Figure 2.5). Of the seven Puget Sound indicator stocks, rates of change in escapement declined significantly for Stillaguamish and Snohomish, and increased significantly for Skagit Spring. Confidence intervals around the rates of change, as well as point estimates, for the remaining four Puget Sound indicator stocks indicate no significant trends. However, due to widely varying escapements, there is considerable uncertainty around rate of change estimates for Skagit River summer/fall Chinook, Green River Chinook, and Nooksack spring Chinook salmon. Although Puget Sound indicator stocks have largely met their agency management objectives (i.e., exploitation rate ceilings) for the time period under consideration, none of them have CTC-approved escapement goals against which trends can be considered. In contrast, 2 of the 9 Washington Coast indicator stocks showed a significant trend in escapement for 1999–2016. Rates of change in escapement decreased significantly for the Grays Harbor spring stock (–3.3%), while they increased significantly for the Queets spring/summer stock (2.6%). Six of the coastal indicator stocks have CTC-approved goals, which have been consistently met for summer/fall (Queets, Quillayute, Hoh), but not spring/summer (Hoh, Queets) run timing groups. Three of the stocks—Hoko, Hoh spring/summer, and Grays Harbor fall—have wide CIs relative to other coastal indicator stocks. In the case of the Hoh and Queets spring/summer Chinook, despite regularly missing goals and returning at levels consistently lower than what was seen historically, the rates of change in escapement for Queets is actually increasing, while the rate of change for Hoh is insignificant, indicating stable escapement.

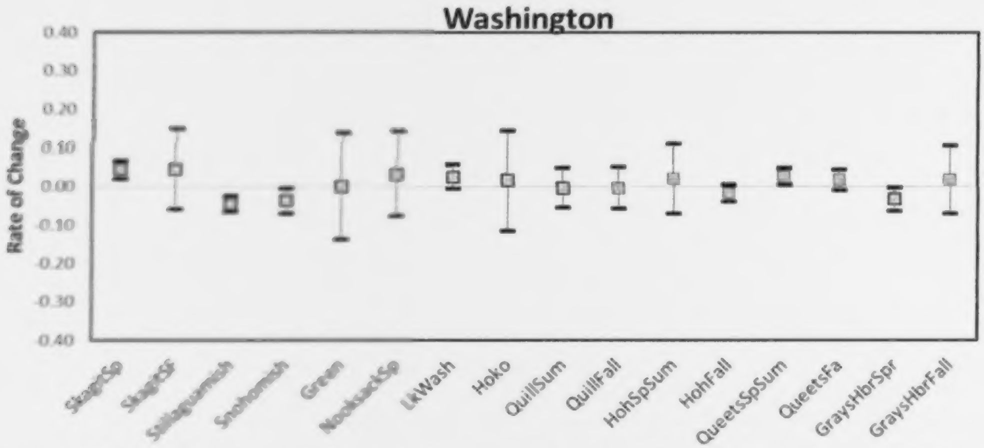


Figure 2.5.–Long-term annual rates of change in escapements for Washington Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals, grey colored squares indicate the stocks do not have CTC-accepted escapement goals. The 2016 Nooksack spring escapement estimate was not available for this analysis.

2.2.5 Escapement Trends for Columbia River/Oregon Stocks

Rates of change averaged 8% for the Columbia River stocks, and ranged from 3.1% (Deschutes) to 10.5% (Columbia Upriver Springs). Rates of change for the Oregon Coast stocks averaged 2.2%, ranging from -2.6% for Coquille to 6% for Umpqua (Figure 2.6).

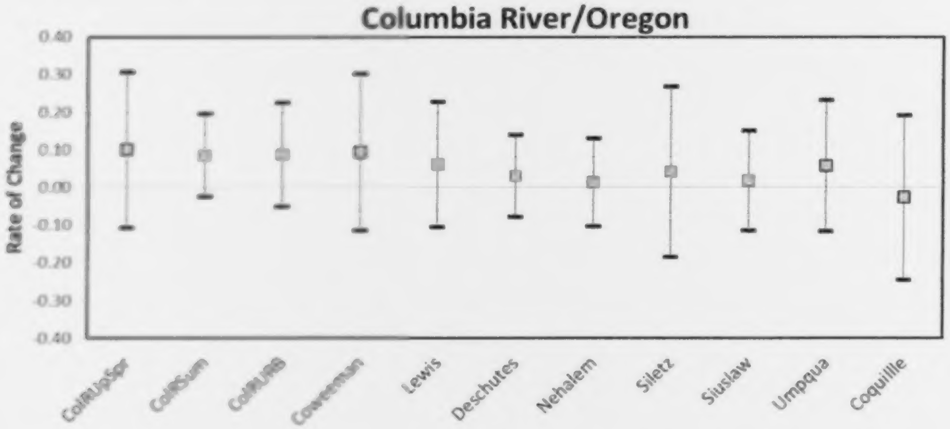


Figure 2.6.–Long-term annual rates of change in escapements for Columbia River/Oregon Chinook salmon stocks.

Note: Squares represent mean rate of change and bars represent 80% CIs. The color green in the squares indicate these stocks have CTC-accepted escapement goals; grey colored squares indicate the stocks do not have CTC-accepted escapement goals.

2.3 PROFILES FOR ESCAPEMENT INDICATOR STOCKS

Escapements are graphed for stocks from Alaska, Canada, Puget Sound, Coastal Washington, Columbia River, and Oregon Coast regions. For each stock a commentary describes escapement methodology, escapement goal basis, escapement evaluation and agency comments. Escapement is usually reported as adult number by calendar year (CY). Escapement goals accepted by the CTC are shown as horizontal reference lines. Historical escapement and terminal run data are provided in Appendix B.

2.3.1 Southeast Alaska Stocks

Estimates for the four SEAK escapement indicator stocks are numbers of large fish, defined as Chinook salmon equal to or greater than 660 mm length from mid eye to tail fork for the Situk, Unuk and Chickamin stocks and age 1.3 and older for the Chilkat stock. Estimates of large fish include mostly ocean-age-3, -4, and -5 fish, which include almost 100% of the females in the population, and the length threshold criterion excludes ocean-age-1 males and a few ocean-age-2 fish. Survey methods have been standardized since 1975 except for the Chilkat River, which was standardized in 1991 concurrent with the initiation of MR escapement estimation. Escapement estimates for the Chickamin River are expanded aerial counts of large spawners. Biological escapement goals for each of these stocks consist of an S_{MSY} point estimate and an escapement goal range.

SEAK stocks are classified into two categories based on ocean migration patterns; inside rearing and outside rearing. Outside-rearing stocks, sometimes referred to as "far north migrating stocks," have limited marine rearing time in SEAK and are harvested primarily during their spawning migrations through marine waters in the spring; this includes the stock returning to the Situk River. Inside-rearing stocks include those vulnerable to SEAK fisheries as immature fish, as well as mature, migrating fish, and include stocks returning to the Chilkat, Unuk, and Chickamin rivers. All SEAK indicator stocks produce primarily yearling smolt except the Situk River, which produces around 90% subyearling smolt.

In 1981, ADF&G established a 15-year rebuilding program and interim point escapement goals for all the SEAK stocks based on the highest observed escapement count prior to 1981. Since then, more rigorous escapement goal analyses by ADF&G have been reviewed and accepted by the CTC. ADF&G uses escapement goal ranges for management, based on the State of Alaska Policy for Statewide Salmon Escapement Goals and Policy for the Management of Sustainable Salmon Fisheries (Title 5 of the Alaska Administrative Code, Chapter 39, sections 223 and 222).

2.3.1.1 Situk River

The Situk River is a non-glacial system near Yakutat, Alaska, that supports a moderate-sized, outside-rearing stock. Most Situk-origin Chinook salmon are caught in sport, commercial, and subsistence fisheries located in-river, in the estuary, and in nearby marine waters. These fisheries are prosecuted under a State of Alaska management plan to achieve escapements within the escapement goal range.

Escapement Methodology: Escapement estimates are weir counts minus upstream sport fishery harvests, as estimated by creel survey and a postseason mail survey. The weir has been operated from 1928 to 1955 and annually since 1976. Counts of large Chinook salmon are reported as the spawning stock. Jacks (ocean-age-1 and -2 fish, not included in Figure 2.7) have ranged from 1,200-4,000 since 1989. Escapements have been continuously enumerated since 1976 and meet U.S. and bilateral CTC data standards.

Escapement Goal Basis: In 1991, ADF&G revised the escapement goal to 600 large spawners (McPherson and Weiland, 1991),[1] and in 1997, the goal was revised to a range of 500– 1,000 large spawners to conform to ADF&G's escapement goal policy. The CTC reviewed and accepted this range in 1998. The analysis was updated by ADF&G in 2003, who recommended a new goal range of 450–1,050 in 2004, but this proposal was not accepted by the CTC.

Escapement Evaluation: Productivity of the Situk River stock has significantly declined over the last decade. Annual escapements less than 85% of the lower bound of the goal have occurred in six of the last nine years and the 2016 escapement is 329 large fish. Similar to 2015, all terminal fisheries were closed in 2016 to pass as many fish to escapement as possible. The 2016 escapement is the 4th lowest since 1976 and is 30% of the 1976 to 2015 average of 1,093 fish. There were no estimated harvests above the weir and this is an exact count of escapement (Figure 2.7).

Agency Comments: Total calendar year exploitation rates (and all harvests within the PSC area) for all gear groups combined averaged about 53% from 1990 to 2003 and these rates have been substantially lower since 2004 because this stock has experienced poor natural survival. Terminal sport and commercial fisheries have been curtailed to reduce impacts from 2010 to 2016.

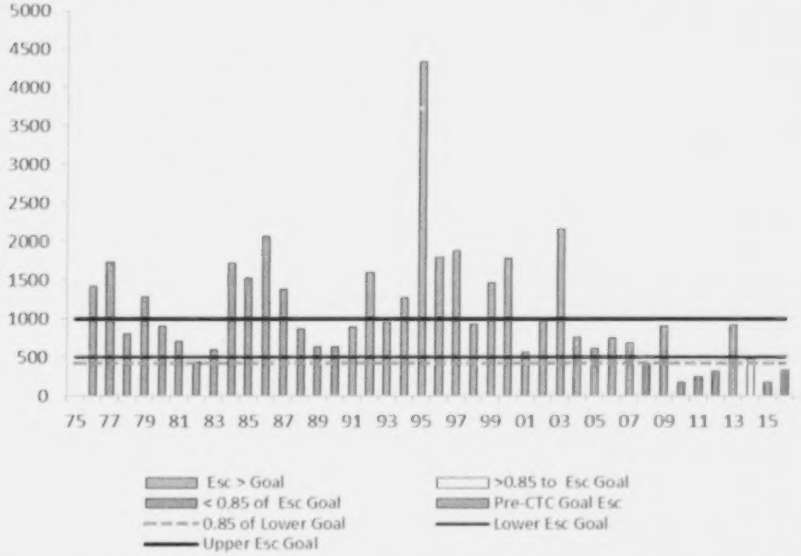


Figure 2.7.–Situk River escapements of Chinook salmon, 1976–2016.

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[1] Scott A. McPherson, ADF&G, to Keith Weiland, ADF&G. 1991 memorandum. Available from author, Douglas Island Center Building, 802 3rd Street, P. O. Box 240020, Douglas, AK 99824-0020.

2.3.1.2 Chilkat River

The Chilkat River is a moderate-sized glacial system near Haines, Alaska, which supports an inside-rearing stock. Coded-wire tags have been applied to wild smolt at relatively high rates (8–10%) beginning with the 1999 brood year; additional wild stock tagging occurred for three broods prior to that time. Relatively small terminal marine sport and subsistence fisheries target this stock. This stock is also caught in SEAK commercial troll, drift gillnet, and sport fisheries.

Escapement Methodology: Escapements of large spawners have been estimated with a MR program annually since 1991 (Ericksen and McPherson 2004). CVs for annual escapement estimates average about 15% since 1991, and assessments have met CTC bilateral data standards in most years. From 1975 to 1992, aerial survey counts were conducted on two small tributaries with relatively clear water and results from these estimates were inconsistent; radio-telemetry studies conducted in 1991 and 1992 found that these two tributaries represented less than 5% of the total escapement Therefore, aerial surveys were discontinued.

Escapement Goal Basis: The 1981 escapement goal was 2,000 large fish, based on an assumed fraction of the total escapement represented by aerial survey counts. A revised escapement goal range of 1,750–3,500 large spawners (Ericksen and McPherson 2004), based on MR estimates of escapement and limited CWT information, was reviewed and accepted by ADF&G and the Alaska Board of Fisheries in 2003 and by the CTC in 2004.

Escapement Evaluation: Escapements to the Chilkat River have been at least 85% of the goal in all years except 2007 and 2016. The 2016 escapement estimate of 1,386 (CV=14%) is below the 85% threshold of the lower bound of the escapement goal range (Figure 2.8).

Agency Comments: Like other Chinook stocks in Alaska, the Chilkat stock has recently experienced a decline in productivity.

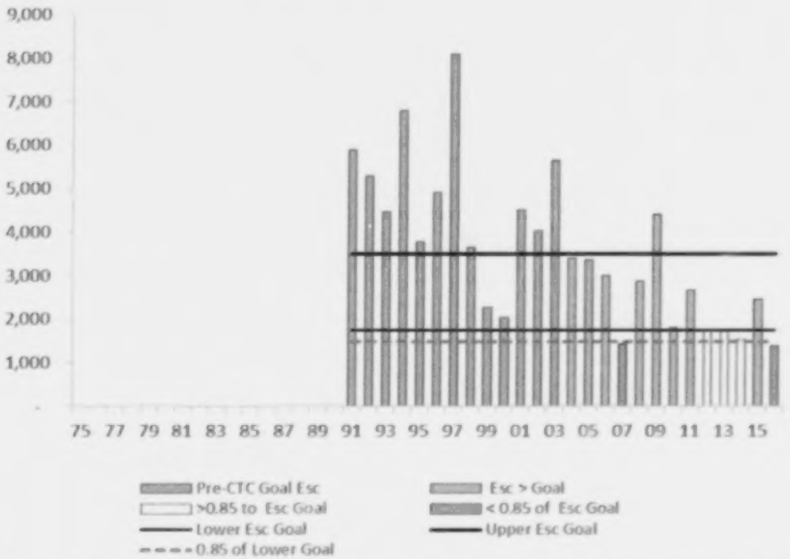


Figure 2.8.–Chilkat River escapements of Chinook salmon, 1991–2016.

2.3.1.3 Unuk River

The Unuk River is a moderate-sized glacial system in Behm Canal near Ketchikan, Alaska, that supports an inside-rearing stock. Escapement estimates are germane to large spawners. Harvests of immature and mature fish occur predominately in SEAK although some fish are also caught in NBC.

Escapement Methodology: Escapements of large spawners are derived from MR estimates of total escapement from 1997 to 2011, and expanded survey counts from 1977 to 1996 and 2012 to present. Radio telemetry studies in 1994 and 2007 showed that the surveys are conducted where 80% of the spawning occurs; the expansion factor for survey counts is 4.83 (Hendrich et al. 2008). Escapement assessments for Unuk River Chinook salmon consistently meet CTC data standards. Since 1997, CVs of estimates have averaged 11% and in all but one year (2011) the annual estimates had CVs of 15% or less. These escapement assessments meet both U.S. and bilateral CTC data standards.

Escapement Goal Basis: In 1994, ADF&G revised the Unuk River escapement goal to 875 large spawners in survey (index) counts, based upon the spawner–recruit analysis reported by McPherson and Carlile (1997), which the CTC reviewed and accepted in 1994. In 1997, ADF&G revised the goal to a range of 650–1,400 large index spawners as recommended in the McPherson and Carlile (1997) report and in compliance with the State of Alaska Policy for Statewide Escapement Goals. The CTC reviewed and accepted this change in 1998. Since the expansion factor for surveys was unknown at that time, the goal was expressed as an index peak survey count. In 2008, a more extensive analysis was done using the 1982-2001 brood years with spawners, recruitment, and fishing mortality expressed in total numbers of fish (Hendrich et al. 2008). In 2009 the CTC accepted a range of 1,800–3,800 large spawners, with a point estimate of 2,764 fish.

Escapement Evaluation: The Unuk River stock has historically demonstrated a healthy status with annual escapements from 1977 to 2011 within or above the escapement goal range in all years. However, productivity of the stock declined dramatically and escapements were below the 85% threshold of the lower bound of the escapement goal range in 2012, 2013, and 2016. The 2016 escapement estimate is 1,463 large Chinook salmon (CV = 12%) which is below the 85% threshold of the lower bound of the goal range. The Unuk River stock, similar to other SEAK stocks, is experiencing a period of low productivity (Figure 2.9).

Agency Comments: The large reduction in run strength of the Unuk River stock in recent years is unexpected given its history of consistent production. There are no directed fisheries that target this stock; sport fishing in freshwater is closed, marine sport fishing in East Behm Canal is closed during the spring and summer, and commercial fishing in nearby marine waters is closed. Additional management measures to reduce exploitation of this stock in the SEAK fishery were implemented from 2014 to 2016, and will continue in 2017. These measures include bag limit reductions and area closures of the marine sport fishery and reduced spring troll fishery openings near Ketchikan.

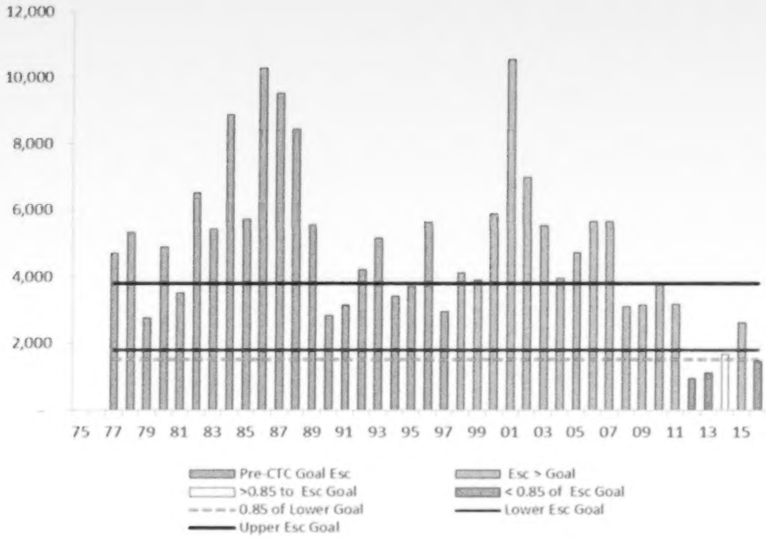


Figure 2.9.–Unuk River escapements of Chinook salmon, 1977–2016.

2.3.1.4 Chickamin River

The Chickamin River is a moderate-sized glacial system in Behm Canal near Ketchikan, Alaska that supports a run of inside-rearing Chinook salmon based on CWT recoveries. There is no terminal fishery targeting this stock; harvests of immature and mature fish occur predominately in SEAK. The majority of fish are harvested in the southern inside quadrant of SEAK by troll and sport gear sectors. There are no subsistence or freshwater fisheries on any of the Behm Canal Chinook salmon stocks. Coded-wire tagging on the Chickamin River was conducted for the 1982 to 1986 broods (Pahlke 1995) and resumed for the 2000 to 2006 broods. Total exploitation rates for recent broods were approximately 28% to 30% in adult equivalents under the current management regime.

Escapement Methodology: Escapements consist of MR estimates of large fish in 1995, 1996, and 2001 to 2005 and expanded survey counts in eight tributaries of the Chickamin River using standardized methodology (Pahlke 2003) from 1975 to 1994, 1997 to 2000, and 2006 to 2016. Comparison of MR and survey counts found that about 21% of the total escapement is counted during peak surveys on average (Weller et al. 2007). A radio telemetry study in 1996 indicated that the annual surveys are conducted in stream reaches where over 80% of all spawning occurs. The expansion factor is estimated at 4.75 for survey counts using the results from the 1995, 1996, and 2001 to 2005 studies, and these assessments meet both U.S. and bilateral CTC data standards.

Escapement Goal Basis: In 1994 ADF&G revised the goal to an index count of 525, which expands to an escapement goal range of 2,150 to 4,300 large spawners as recommended in the McPherson and Carlile (1997) report. The index count and escapement goal were reviewed and accepted by the CTC in 1998.

Escapement Evaluation: The Chickamin River stock shows a cyclic pattern of escapement since 1975. Annual escapements less than 85% of the goal have occurred eight times from 1975 to 1998, and again in 2016. The 2016 escapement index is 203 large spawning Chinook salmon, which expands to 964 fish (CV = 15%) and is below the lower bound of the escapement goal range (Figure 2.10).

Agency Comments: The Chickamin River produces the largest-bodied Chinook salmon of the four SEAK escapement indicator stocks. The time series of survey counts follows two cycles: counts from 1975 to 1981 and 1992 to 1998 were below the goal range, and those from 1982 to 1991 and 1999 to 2011 were all within or slightly above the range. The 2013–2015 escapements for this stock were slightly higher than the recent low point observed in 2012; however, the 2016 escapement plummeted to the second lowest estimate since 1975. Overall, the Chickamin River stock has shown different escapement patterns than the majority of SEAK Chinook salmon stocks.

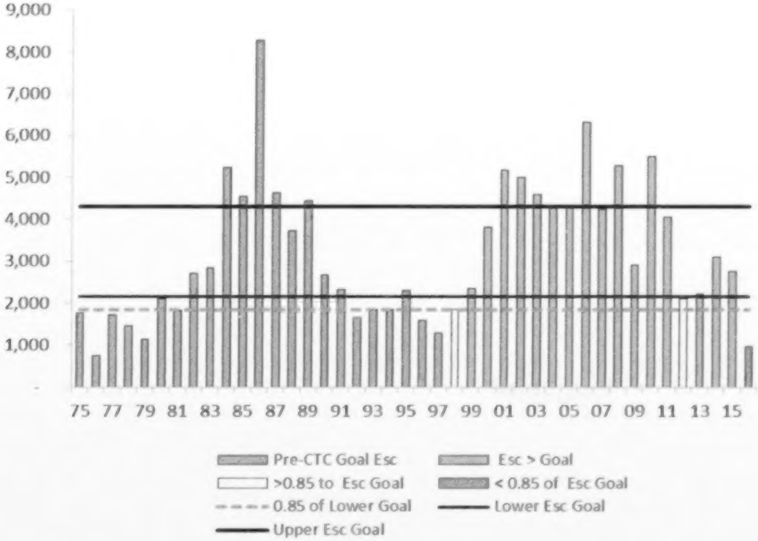


Figure 2.10.–Chickamin River peak index counts of Chinook salmon, 1975–2016.

2.3.2 Transboundary River Stocks

The TBR stocks include Chinook salmon returning to the Alsek, Taku, and Stikine rivers. Escapement estimates in the Taku and Stikine rivers are germane to large fish, defined as Chinook salmon equal to or greater than 660 mm length mid eye to tail fork, and include ocean age-3 through age-5 fish, which contain almost 100% of the females in the population. Escapement estimates in the Alsek River are germane to age 1.2 and older fish. Survey methods have been standardized since 1973 in the Taku River and since 1975 in the Alsek and Stikine rivers. Biological escapement goals are in place for each of these stocks which consist of point estimates of S_{MSY} and escapement goal ranges.

All three TBR stocks can be classified as outside rearing based on ocean rearing distributions. These fish have limited marine rearing time in SEAK and are harvested primarily during their spawning migrations each spring. These fish are also mostly yearling smolt and return as ocean-age-1 through ocean-age-5 adults.

In response to low abundance, a 15-year rebuilding program was established by the ADF&G in 1981 (ADF&G 1981). At the same time, ADF&G established interim escapement goals for all three systems, based on the highest observed escapement count prior to 1981. Escapement goals for all three TBR stocks have subsequently been revised by ADF&G and DFO which have been reviewed and accepted by the CTC, Canadian Centre for Science Advice Pacific, and the TBR Panel. Escapement goal ranges are used by ADF&G for management, as described in the State of Alaska Policy for Statewide Salmon Escapement Goals and Policy for the Management of Sustainable Salmon Fisheries.

2.3.2.1 Alsek River

The Alsek River is a large glacial system that originates in Canada in the SW Yukon Territory and NW British Columbia, and flows into the Gulf of Alaska about 50 miles east of Yakutat, Alaska. This river supports a run of outside-rearing Chinook salmon.

Escapement Methodology: Since 1976, escapements have been monitored by a weir operated in the Yukon Territory, Canada on the Klukshu River, which is one of 51 tributaries of the Tatshenshini River, the principal salmon-producing branch of the Alsek River. At the Klukshu River weir, counts of returning age 1.2 and older Chinook have been collected from 1976 to present. Concurrent with the weir counts, Alsek River drainage-wide escapement estimates were produced from 1998 to 2004 using direct MR through a cooperative effort among the Champagne and Aishihik First Nations, DFO, and ADF&G. The average expansion factor of 4.00 is used to convert the Klukshu River inriver run to Alsek River drainage-wide inriver run estimates. Once Canadian inriver harvest is subtracted from inriver abundance, drainage-wide escapement is estimated for the Alsek River stock. The associated CV of 35% for the expansion factor meets U.S. CTC data standards yet fails to meet bilateral CTC data standards.

Escapement Goal Basis: A revised goal of 3,500 to 5,300 age 1.2 and older fish was accepted by the CTC, ADF&G, and Canadian Science Advisory Pacific, based on analysis in Bernard and Jones (2010). Prior to this, the goal was based on the run seen in the Klukshu River (McPherson et al. 1998).

Escapement Evaluation: Annual escapements of less than 85% of the goal have been observed four times since 1976, and all have occurred in recent years. Calendar year exploitation rates exerted on the stock have averaged 10% since 1999. If no harvest had occurred in 2006, 2007, 2008, and 2016, the stock would still have failed to achieve the lower bound of the escapement goal range. The 2016 escapement estimate is 2,574 (CV = 0.35) age 1.2 and older Chinook salmon, which is below the 85% threshold of the lower bound of the escapement goal range (Figure 2.11).

Agency Comments: Directed sport and Aboriginal fisheries occur in Canada in various upriver sections of the Alsek River and mostly in the Yukon Territory. Some Chinook salmon are caught incidentally in the U.S. directed sockeye salmon fishery that takes place in the lower river, and a few are also caught in a U.S. subsistence fishery that takes place in the same area. Overall, calendar year exploitation rates have averaged only 12% since 1976 (Bernard and Jones 2010).

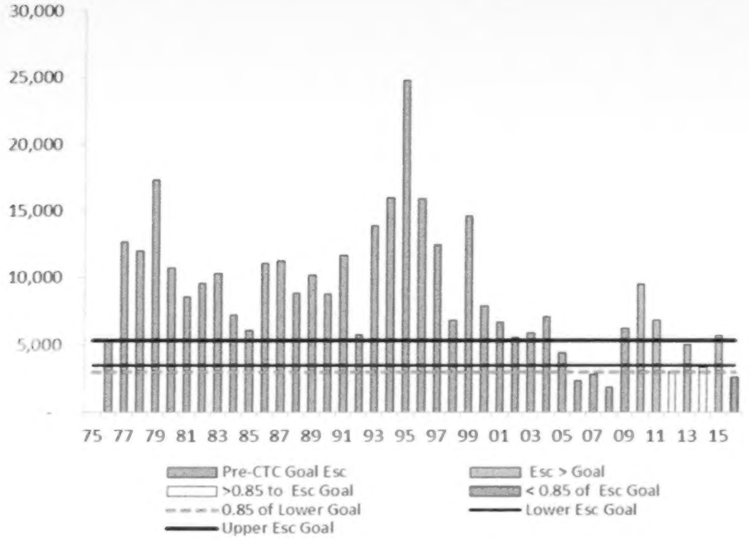


Figure 2.11.–Alsek River escapements of Chinook salmon, 1976–2016.

2.3.2.2 Taku River

The Taku River is a large glacial system that supports a run of outside-rearing Chinook salmon. Taku River Chinook salmon are sporadically caught in SEAK fisheries, but most catch occurs in terminal areas including District 111 of SEAK and in the Canadian portion of the lower Taku River. Directed gillnet fisheries take place in terminal U.S. (District 111 of SEAK) and Canadian inriver fisheries when forecasted abundance or inseason assessment exceeds predetermined levels as described in the 2009 Agreement under Chapter One, Transboundary Rivers 3(b)(3). In other years, Taku River Chinook are also incidentally harvested in terminal directed sockeye salmon gillnet fisheries, sport fisheries near Juneau, Alaska, and inriver in Aboriginal fisheries in Canada.

Escapement Methodology: Escapement estimates of large Chinook salmon have been generated through MR experiments in 1989, 1990, 1995–1997, 1999–2012, and 2014–2016. The MR estimates are from cooperative stock assessment efforts among the Taku River Tlingit First Nations, DFO, and ADF&G. Taku River Chinook salmon MR escapement assessments have an average CV of 15% and since 1995 have ranged 9% to 38%; most assessments meet bilateral CTC data standards. Standardized aerial survey counts have been performed by ADF&G since 1973. Counts prior to 1989, 1991–1995, 1998, and 2013 were expanded by a factor of 5.2, which is the average of the ratio of the MR estimates to aerial survey counts. Escapement estimates based upon expanded aerial survey counts are assumed to be unbiased and have a CV of about 30%.

Escapement Goal Basis: Prior to 1999, several drainage-wide or index goals were developed by the U.S. and Canada using limited data. A goal based upon maximizing smolt production was in place from 1999 to 2009 (McPherson et al. 2000). In 2009, an escapement goal of 19,000 to 36,000 large Chinook salmon, based upon stock–recruit analysis (McPherson et al. 2010), was accepted by the CTC.

Escapement Evaluation: The Taku River Chinook salmon stock is reasonably healthy with annual escapements of less than 85% of the lower bound of the goal range occurring only four times since 1975 (1975, 1983, 2007, 2016). The 2016 escapement estimate is 12,381 (CV = 12%) large Chinook salmon, which is below the 85% threshold of the lower bound of the escapement goal range and approximately half of the S_{MSY} point goal of 25,500 (Figure 2.12).

Agency Comments: Taku River Chinook salmon are both an escapement and an exploitation rate indicator stock. Currently DFO and ADF&G operate joint programs to mark and tag smolt with adipose fin clips and CWTs, respectively, in order to estimate smolt abundance and adult production, as well as to estimate harvest in mixed stock fisheries and exploitation rates. Historically, a significant terminal marine gillnet fishery occurred, but stock assessment was not adequate for management. In 2005, the Parties developed an abundance-based management regime for Taku River-origin Chinook salmon with harvest sharing arrangements specified in Chapter One of Annex IV. This regime includes preseason forecasts, inseason run projections, and postseason assessments which, when coupled with carefully controlled weekly openings of gillnet fisheries on both sides of the border, has allowed sustained harvest while ensuring escapement needs are met. The Taku River stock has shown declining productivity in recent years and the primary factor is reduced marine survival. Until these conditions improve, it is unlikely that directed fisheries will be prosecuted.

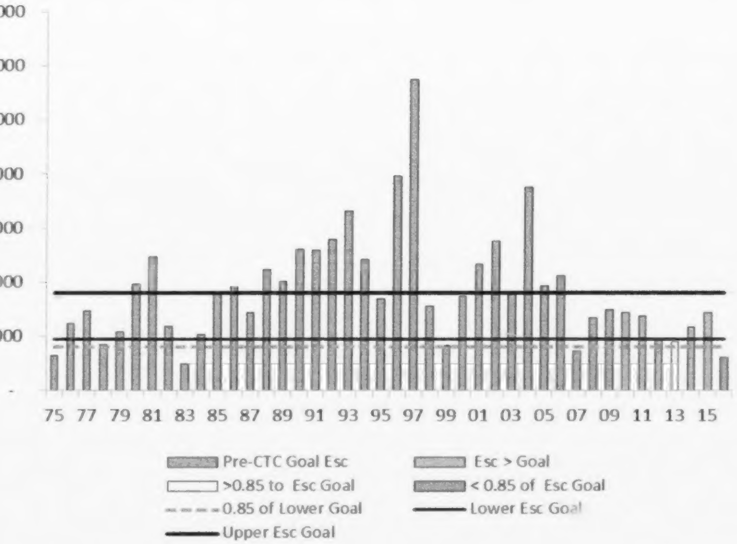


Figure 2.12.–Taku River escapements of Chinook salmon, 1975–2016.

2.3.2.3 Stikine River

The Stikine River drainage is the largest in SEAK, originates in British Columbia, and flows into the ocean in central SEAK near the towns of Petersburg and Wrangell. The Stikine River supports a run of outside-rearing Chinook salmon and most harvest occurs in terminal areas, including U.S. commercial gillnet and sport fisheries in District 108 near Petersburg and Wrangell. There are also commercial gillnet and Aboriginal fisheries in the Canadian portion of the drainage. Stikine Chinook salmon are also harvested outside of the terminal areas in SEAK spring troll fisheries and, to a more limited extent, in SEAK sport fisheries. Starting in 2005, during years of surplus production to the Stikine River, directed Chinook salmon fisheries were allowed in District 108 marine waters near Petersburg and Wrangell and inriver in Canada.

Escapement Methodology: From 1975 to 1984, index escapement estimates were generated using survey counts performed by ADF&G, and since 1985, counts were made through a weir placed in the Little Tahltan River operated by the Tahltan First Nations. Since 1996, MR experiments were conducted annually to estimate total escapement. The MR estimates are cooperative stock assessment efforts among the Tahltan First Nations, DFO, and ADF&G. Combined, these efforts indicated weir counts represented 17% to 20% of the total escapement (Pahlke and Etherton 1999). Since 1996, 43% of the escapement estimates have had CVs exceeding bilateral CTC data standards, and overall CVs range from 7% to 28%.

Escapement Goal Basis: An escapement goal of 14,000 to 28,000 large Chinook salmon was established in 1999 after review and acceptance by the CTC, ADF&G, TBR Panel, and Canadian Science Advisory Pacific, based on the analysis in Bernard et al. (2000). Previously, several drainage-wide or index goals were developed by the U.S. and Canada, and were based on limited data.

Escapement Evaluation: The Stikine River stock is reasonably healthy with annual escapements of less than 85% of the lower bound occurring six times since 1975 and only once in the past 28 years (2009). The 2016 escapement estimate is 10,343 (CV = 19%) large Chinook salmon, which is below the 85% threshold of the lower bound of the escapement goal range (Figure 2.13).

Agency Comments: Currently DFO and ADF&G operate joint programs to mark and tag smolt with adipose fin clips and CWTs, respectively, to estimate smolt abundance and adult production. Since 1985, escapements to the Stikine River have been within or above the escapement goal range except in 2009. Despite reaching escapement goals similar to Taku River Chinook salmon and stocks in SEAK, the Stikine River stock has demonstrated declining productivity in recent years and the issue is due to poor marine survival. Until production improves, it is unlikely that directed terminal fisheries will be prosecuted.

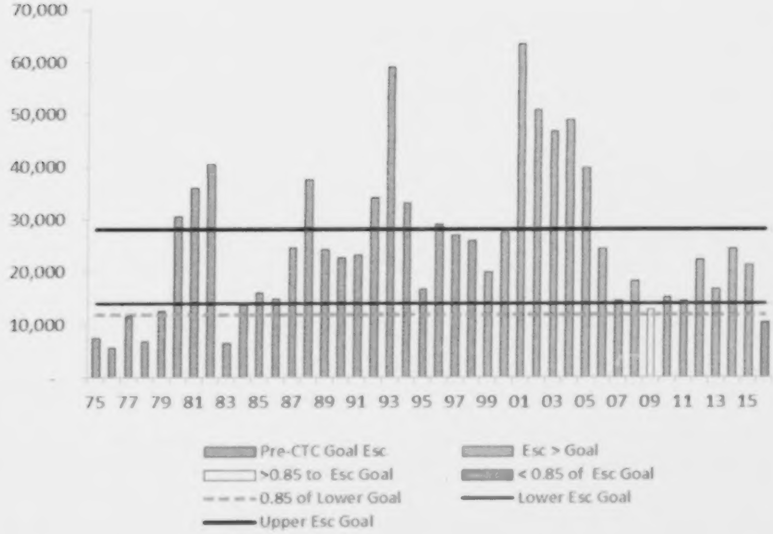


Figure 2.13.–Stikine River escapements of Chinook salmon, 1975–2016.

2.3.3 Canadian Stocks

Since the beginning of the Chinook salmon rebuilding program of the 1985 PST, escapement goals for Canadian Chinook stocks were generally based on doubling the average escapements recorded from 1979 to 1982. The doubling was based on the premise that Canadian Chinook stocks were overfished and that doubling the escapement would still be less than the optimal escapement estimated for the aggregate of all Canadian Chinook salmon populations (PSC 1991). Doubling was also expected to be a large enough change in escapements to allow detection of the change in numbers of spawners and the subsequent production. The escapement goals of most Canadian stocks are currently being reviewed; two stocks (Harrison and Cowichan) have CTC-accepted escapement goals.

2.3.3.1 Northern British Columbia

2.3.3.1.1 Yakoun River

The CTC was unable to assess stock performance because Yakoun River Chinook salmon escapements have not been estimated since 2005. See Appendix Table B3 for escapement estimates up to 2005.

2.3.3.1.2 Nass River

The Nass River is the largest river in Area 3, representing a group of approximately 25 streams. It flows southwest from the interior of British Columbia into Portland Inlet and the estuary is located 30 km south of the Alaska/British Columbia border. The Nass River drains an area of approximately 18,000 km^2 and is constrained by a canyon at Gitwinksihlkw (GW). The canyon was formed by the Tseax Volcano in 1775 and is approximately 40 km upstream from the estuary. The mainstem of the Nass River is extremely turbid with visibility near zero for most of the year. Among the major Chinook salmon producing tributaries, the Bell Irving River is glacially turbid while the Meziadin, Cranberry/Kiteen, Kwinageese and Damdochax rivers are relatively clear. Nass River Chinook salmon are primarily stream-type salmon and are thought to be far north migrating.

Escapement Methodology: Prior to 1992, DFO observations of Nass River Chinook salmon escapement were based on visual counts. Programs using MR have been conducted since 1992 by the Nisga'a Fisheries to estimate total spawning escapement in the Nass River. The Nass MR program uses two fish wheels at Gitwinksihlkw in the Lower Nass canyon and occasionally two wheels at Grease Harbor further upstream to apply tags. The Meziadin River fishway, a weir on the Kwinageese River, and a deadpitch program on the Damdochax River are used for tag recovery. Tags were also recovered in upriver fisheries and on the spawning grounds. A modified Petersen model was used to estimate the total population of Chinook salmon past the tagging location. Spawning escapements were calculated as the estimated population past Gitwinksihlkw from the MR studies, minus upriver catches in sport and First Nations fisheries. Three tributaries with Chinook populations—the Kincolith, Ishkeenickh and the Iknouk—enter the Nass River below Gitwinksihlkw. Visual estimates of these systems were augmented by fence counts of the Kincolith River in 2001, 2002, 2005, and 2007 to estimate escapements below the fish wheels.

Escapement Goal Basis: There is no CTC accepted escapement goal for this stock. The Fisheries Operational Guidelines define two goals for managing Chinook salmon fisheries: an operational escapement target of 20,000 fish, and a minimum escapement target of 10,000 fish. If escapements are projected to be below 10,000 fish, then no fishing on Nass River Chinook salmon would be recommended. The median estimate of S_{MSY} for the Nass River upstream of Gitwinksihlkw using the habitat model was 16,422 (CV = 23%) Chinook salmon based on a watershed area of 15,244 km^2 (Parken et al. 2006; Figure 2.14).

The 2016 escapement estimate for the Nass River above Gitwinksihlkw was 9,037 (Appendix Table B3; Figure 2.14).

Agency Comments: Chinook salmon escapement estimates produced before 1992 have been calibrated to the MR estimates. The Nisga'a Fisheries Working group, including DFO, has accepted the historical escapement and terminal run values. The Sentinel Stocks Program (SSP) funded a project on the Kwinageese River and Damdochax Creek designed to increase recoveries and improve the escapement estimates for the Nass Chinook aggregate.

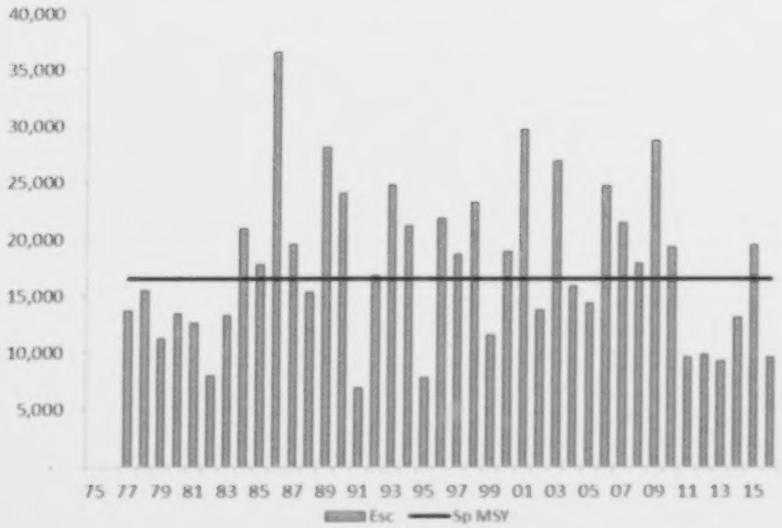


Figure 2.14.–Nass River escapements of Chinook salmon, 1977–2016.

2.3.3.1.3 Skeena River

The Skeena River is the second largest river in British Columbia and drains an area of approximately 54,400 km^2. It supports the second largest aggregate of Chinook salmon stocks in British Columbia with over 75 separate spawning populations. Four large lake-stabilized tributaries, Kitsumkalum, Morice, Babine and Bear rivers, account for 63% of the total abundance in the Skeena River. The Kitsumkalum River is glacially turbid and visual methods for enumerating salmon are not possible. By comparison, the Morice, Bear, Babine, and Kispiox rivers run relatively clear, especially in late summer when most of the Chinook salmon spawning occurs. Skeena River Chinook salmon are primarily stream-type salmon (approximately 97%), and are far north migrating. Most of the Skeena River Chinook salmon populations are summer run, but spring run fish occur in the Cedar River and the Upper Bulkley River.

Escapement Methodology: Most of the escapement estimates are based on visual observations from helicopter, fixed wing aircraft and/or from stream walking surveys but fish counting weirs are present on the Babine, Sustut, and Kitwanga rivers. The Kitsumkalum River is the exploitation rate indicator stock for Northern British Columbia, and the spawning population has been estimated using a MR program since 1984. The Kitsumkalum represents approximately 30% of the spawners measured by the Skeena escapement index. The Bear and Morice river populations have contributed 20% and 26% respectively to the escapement index since 1984. The visual estimates for these systems tend to underestimate their actual contribution to the total escapement in the Skeena aggregate.

Chinook salmon returns to the Skeena River have also been estimated using the proportion of Kitsumkalum River fish measured from genetic samples collected at the Tyee test fishery and from Kitsumkalum Chinook escapement estimates from independent MR programs (Figure 2.15, checkered bars). Preliminary estimates are available from 1984 to 2016 as a result of SSP and Northern Fund projects. The genetic-based estimates represent an improvement over the historic indices because they include estimates of variance which cannot be produced for the historic indices. Also, comparisons between years are valid since the method is consistent across the time series, whereas methods used for the historic indices varied through time.

The genetic studies found that the Kitsumkalum River conservation unit contributes, on average, 18% to the Skeena River aggregate. The Morice, Bear, and Babine populations make up the Skeena Large Lake conservation unit and contribute 31%, 7.4% and 6.6% to the aggregate respectively. An average contribution of 45% makes the Skeena Large Lake conservation unit the largest in the watershed. The estimated 2016 escapement for the Skeena stock was 34,153 using the historic index and 31,297 using the genetic estimate (Appendix Table B3; Figure 2.15).

Escapement Goal Basis: There is no CTC-accepted escapement goal for the Skeena River aggregate. The estimate of S_{MSY} for the Kitsumkalum indicator stock is 8,621 Chinook salmon based on stock–recruitment analyses (McNicol 1999; updated in Parken et al. 2006). Habitat-based estimates of S_{MSY} and other reference points are available for stocks within the Skeena River, but estimates of total escapement (or calibration of the visual indices) are needed to make them effective (Parken et al. 2006). Future assessments will partition this large aggregate into stocks by run timing, life history, and geographic areas.

Agency Comments: Terminal fisheries in the Skeena River include commercial gillnet in the terminal exclusion area (River Gap Slough, Area 4), inriver sport, and aboriginal fisheries. Estimates of inriver sport catch were not available from 1997 to 2002 but creel surveys were conducted on the Lower Skeena below Terrace in 2003 and 2010–2015. Consequently, the total terminal run estimates in these years include lower-river sport catch but no estimate of upper-river sport catch. Spawning escapements to the Kitsumkalum River have exceeded the point estimate of S_{MSY} in every year since 1998 (Figure 2.16).

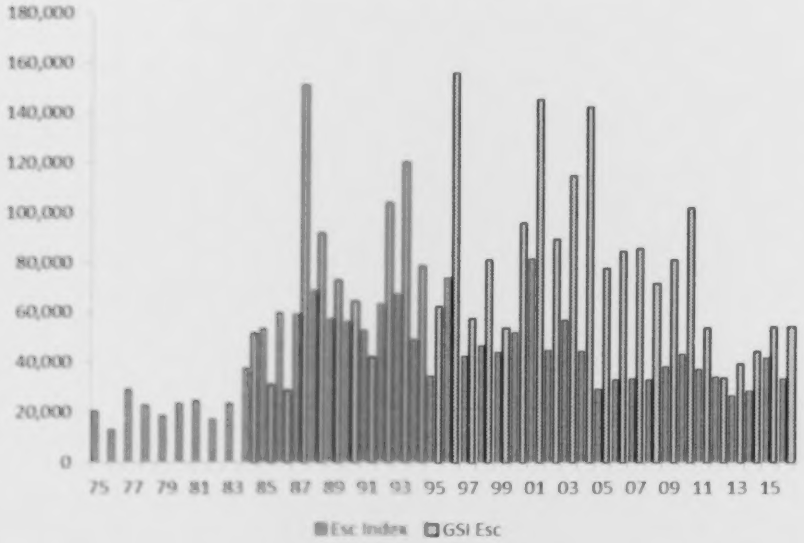


Figure 2.15.–Skeena River escapements of Chinook salmon, 1975–2016.

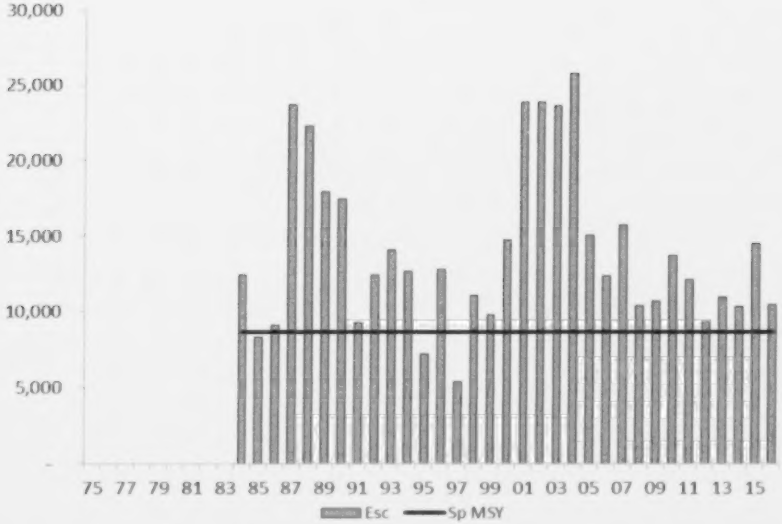


Figure 2.16.–Kitsumkalum River escapements of Chinook salmon, 1984–2016.

2.3.3.2 Central British Columbia

2.3.3.2.1 Dean River

Chinook salmon populations in Area 8 consist of seven non-enhanced systems, and the two enhanced systems are the Bella Coola and Atnarko River system. Among non-enhanced systems, the Dean River, located along the central west coast of British Columbia, has the largest spawning population and the most consistent escapement surveys in this region. The Dean River originates at Nimpo Lake approximately 150 km east of the community of Bella Coola and flows in a northwesterly direction for approximately 253 km before entering the Dean Channel. Chinook returning to the Dean River exhibit summer run timing and are predominantly stream type (94%).

Several tributaries provide salmon spawning habitat between Nimpo Lake and Dean Channel including the Takia River, Tahyesco River, and Sakumtha Creek. Salmon House Falls near the confluence of the Takia River and Dean River is the upstream limit to the migration of spawning salmon. Spawning Chinook have been observed in the Takia River near the lower Tanya Lake, in Tahyesco River as far as Compass Creek, and in Sakumtha Creek near Skuce Creek.

Between 2012 and 2014 and in 2016, the CTC was unable to assess stock performance because Dean River Chinook salmon escapements were not estimated due to insufficient resources. In 2015 funds were secured for aerial assessment. See Appendix Table B3 for escapements through 2016.

Escapement Methodology: Since 2001 the Chinook salmon escapement index for the Dean River has been derived using area-under-the-curve (AUC) methodology based on three aerial counts. In years where viewing conditions were poor, a maximum likelihood procedure has been used (e.g., 2004). A Chinook salmon MR program was conducted on the Dean River in 2006 to develop an expansion factor for converting the escapement indices into estimates of total escapement.

Escapement Goal Basis: There is no CTC-accepted escapement goal for this stock. Biologically based goals for this complex of Chinook spawning populations have not yet been developed. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available (median S_{MSY}=3,646, CV=14%), but estimates of total escapement are needed to make them effective.

Agency Comments: Chinook escapement was not estimated between 2012 and 2014, and funding was not secured for the 2016 season. Terminal fisheries in the Dean River included commercial and inriver sport fisheries.

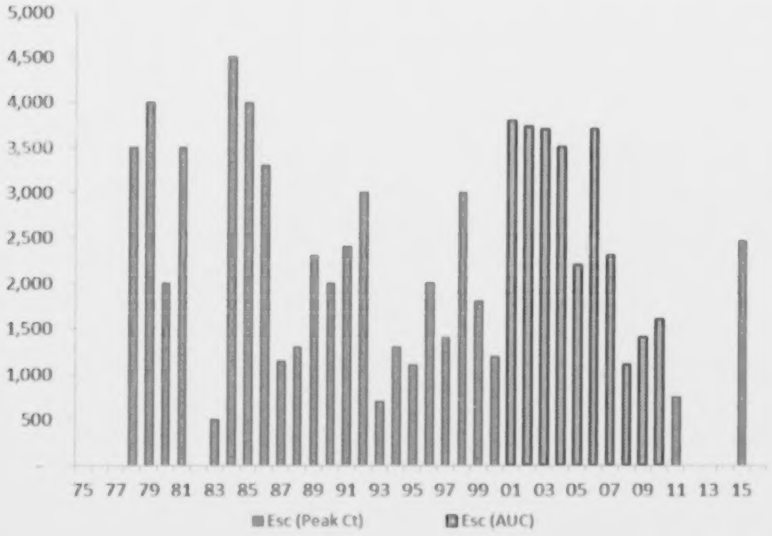


Figure 2.17.–Dean River escapements of Chinook salmon, 1978–2015.

2.3.3.2.2 Rivers Inlet

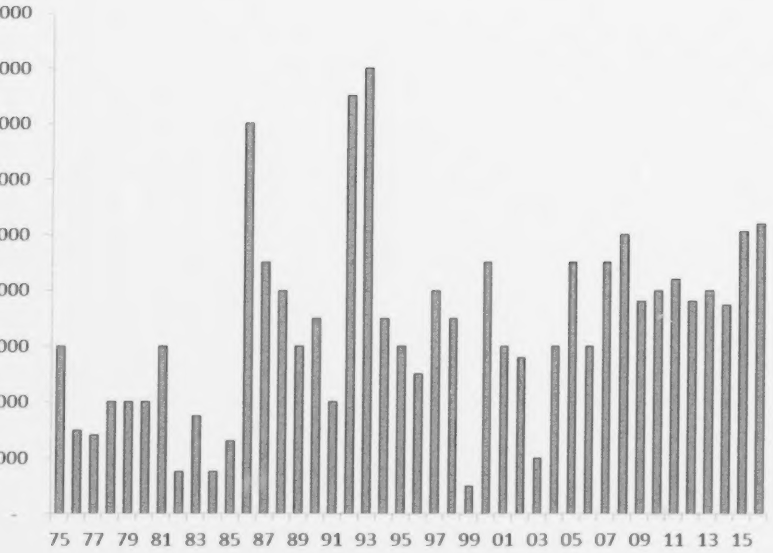
The Rivers Inlet escapement index consists of an aggregate of Chinook salmon escapements to the Wannock, Kilbella, and Chuckwalla rivers. The Wannock River drains Owikeno Lake into the head of Rivers Inlet. It is about 6 km long, over 100 m wide, and is glacially turbid. Wannock Chinook salmon are genetically distinct from other Chinook salmon populations in the central coast of British Columbia. This ocean-type stock exhibits fall run timing and is renowned for its large body size, due to ocean-age-4 and age-5 year components in the return. The Kilbella and Chuckwalla river systems share an estuary on the north shore of Rivers Inlet. These systems are relatively small and run clear, but the degree of turbidity fluctuates with seasonal precipitation. The Chinook salmon populations in the Chuckwalla and Kilbella rivers have summer run timing and are stream-type salmon. The largest contributor to the index is the Wannock River, which represents an average of 76% of the production for this index over the past decade, and over 95% since 2010. The 2016 escapement for the Wannock was estimated at 5,200, and for the Chuckwalla/Kilbella rivers not available (Appendix Table B3; Figure 2.18).

Escapement Methodology: Chinook salmon escapement estimates for the Wannock River are produced from an annual carcass recovery program. Estimates are derived by expanding the number of carcasses pitched based on historical recovery rate assumptions. Expansion factors are somewhat subjective and take into consideration water clarity, river height, and recovery effort. The visual index estimate for Wannock Chinook salmon in 2016 was 5,200 based on expansion of carcasses recoveredduring the traditional dead-pitch program. Programs to calibrate carcass recoveries with population estimates from MR experiments were conducted from 1991 to 1994 and again in 2000. Results suggest the estimates based on the subjective expansions of carcass recoveries may underestimate the Wannock Chinook salmon population. Inherent bias as well as imprecision in the MR estimates leads to uncertainty in calibration of the carcass estimates.

Chinook salmon escapements for the Chuckwalla and Kilbella rivers are estimated using AUC methods applied to visual counts from helicopter surveys. Typically four flights are made during the spawning period. The 2016 estimated escapement to the Chuckwalla River and to Kilbella River was estimated only as adults present. There were only 2 assessment flights to the Chuckwalla, and only one successful flight to Kilbella. The second flight revealed a land slide near the top that made the water to murky to count.

Escapement Goal Basis: There is no CTC-accepted escapement goal for these stocks. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available but estimates of total escapement are needed to make them effective. Habitat-based escapement goals may overestimate S_{MSY} for the Wannock River because the stock is limited by the relatively small amount of spawning area available (Parken et al. 2006).

Agency Comments: A small hatchery enhancement program occurs on the Wannock River but the contribution to the total population is unknown. Production from enhancement of the Kilbella and Chuckwalla rivers from 1990 to 1998 is thought to have had significant influence on escapements from 1994 to 2003, but estimates of the enhanced component are not available. However, estimated returns to the Kilbella and Chuckwalla rivers averaged 1,300 Chinook salmon during the period of enhancement. Recent returns have averaged less than 500 Chinook salmon for both rivers combined; it is unclear if these populations have returned to pre-enhancement levels or are experiencing an unrelated decline.



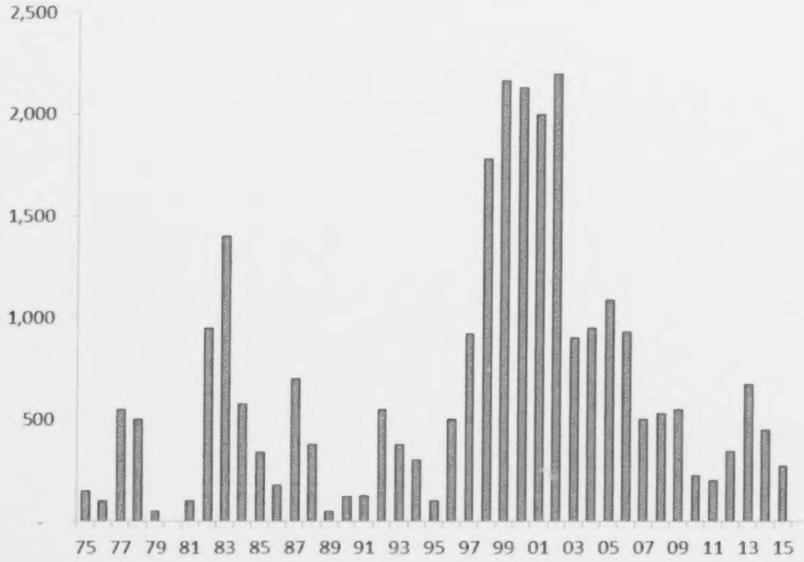


Figure 2.18.–Rivers Inlet escapement index of Chinook salmon, 1975–2016, including Wannock River (upper) and Kilbella and Chuckwalla rivers (lower).

2.3.3.2.3 Atnarko River

Following the 2009 PST Agreement, the CWT Improvement Program highlighted the lack of a Chinook salmon indicator in the Central British Columbia region. In order to convert the existing Atnarko Chinook Assessment program into an exploitation rate indicator, a series of objectives were identified including the application of 250,000 additional CWTs, sampling of the terminal commercial, sport, and First Nations fisheries, and reintroduction of an MR program to improve escapement estimates (Velez-Espino et al. 2011). Implementation of these changes began in 2009 (Velez-Espino et al. 2010) and subsequent MR programs have yielded escapement estimates with corresponding CVs of less than 15% for all years (Velez-Espino et al. 2014). The estimated total escapement for the Atnarko in 2016 was 24,234 and the wild escapement 9,737 (Appendix Table B3; Figure 2.19).

The Northern/Central CTC model stock group is represented by Kitsumkalum River which is a stream-type stock, while the Atnarko River, which feeds the Bella Coola River and is situated in Statistical Area 8 on the Central Coast of British Columbia, is predominantly an ocean-type stock. It constitutes the largest complex of Chinook salmon in Central British Columbia. Hatchery releases of Atnarko Chinook salmon have averaged around 2 million annually with recent CWT releases in excess of 400,000. Atnarko CWT recoveries occur in both U.S. and Canadian AABM fisheries as well as coastal British Columbia ISBM fisheries.

Escapement Methodology: Three methods have been used since 1990 to generate independent estimates of Chinook salmon escapement in the Atnarko River. These methods are based on (1) catch per unit effort (CPUE) during broodstock collection, (2) carcass counts during dead pitching, and (3) the number of spawners observed during drift boat surveys. The simplicity and low cost of these three methods has allowed the continuous monitoring of Atnarko escapement, and the average of these three population estimates (3MA method) has been used as escapement estimates in years without MR studies. A serious flood event in the fall of 2010 impacted the Atnarko by altering flow dynamics and creating a sequence of obstructive log jams. As a result, the use of rafts to obtain drift counts was no longer feasible. Robust maximum likelihood estimates within a model selection framework have been developed for escapement of total and wild Atnarko Chinook salmon, based on MR data for years 2001–2003 and 2009–2016. The 1990–2016 time series of Atnarko Chinook salmon escapement was calibrated using Generalized Linear Models based on these high-quality escapement estimates and data routinely collected for the 3MA method (Vélez-Espino et al. 2014). The estimation model used for time series calibration also serves as a tool to generate reliable escapement estimates based on broodstock CPUE and carcass counts. The calibrated escapement estimates have yielded escapement estimates with corresponding CVs of less than 15% for all years, except 1995 (17.9%) and 2006 (15.6%; Velez-Espino et al. 2014).

Escapement Goal Basis: There is no CTC-accepted escapement goal for Atnarko Chinook salmon. A habitat-based escapement goal (Parken et al. 2006) of 5,009 wild fish has been developed for Atnarko Chinook salmon (Vélez-Espino et al. 2014). This habitat-based escapement goal represents a first iteration in the process of refinement required to quantify the spawning escapement at S_{MSY} for this stock (Figure 2.19).

Agency Comments: The Atnarko River has been developed as an exploitation rate indicator stock (Velez-Espino et al. 2011). MR estimates with corresponding CVs less than 15% have been attained in 10-program years (2001–2003 and 2009–2016). The estimation model used for the 1990–2013 time series calibration can also generate reliable escapement estimates based on broodstock CPUE and carcass counts. In future years when MR data are absent carcass counts used with a calibrated time series of escapement, provide a method to produce escapement estimates. Future calibrations would be required for years without MR data and will include new data derived from subsequent MR studies. This was not necessary for 2016, because MR studies took place for Atnarko Chinook salmon.

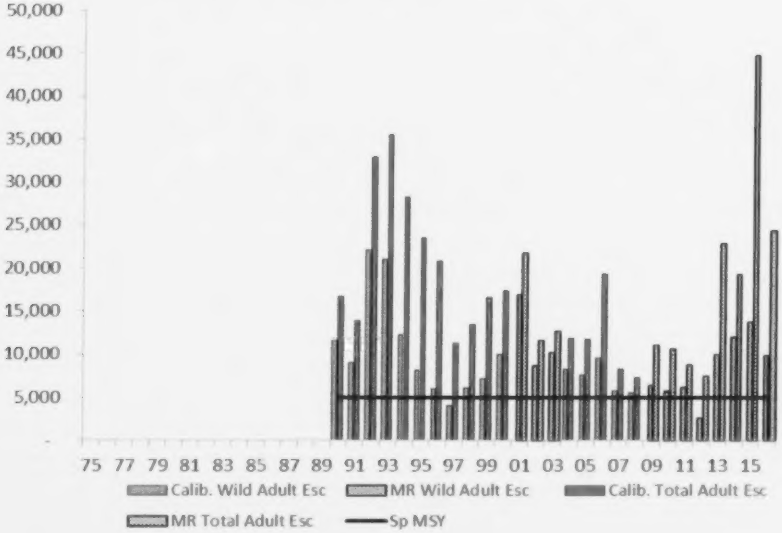


Figure 2.19.–Atnarko River escapements of wild adult (excluding jacks) and total adult (hatchery and wild, excluding jacks) Chinook salmon, 1990–2016.

2.3.3.3 West Coast Vancouver Island and Georgia Strait

2.3.3.3.1 West Coast Vancouver Island

Escapement Methodology: The WCVI index represents the sum of escapements for six rivers (Marble, Tahsis, Burman, Artlish, Kaouk, and Tahsish), which were chosen to provide an index of escapement for wild WCVI stocks in general. These stocks were chosen based on historical consistency of data quality, although the escapement methodology changed in 1995 and prior estimates have not been calibrated to the new methodology. DFO also developed a 14-stream expanded index which includes escapements to the 6-stream index plus the following WCVI streams: Colonial/Cayegle (Area 26); Leiner (Area 25); Megin, Bedwell/Ursus, Moyeha (Area 24); Sarita, Nahmint (Area 23); and San Juan (Area 21). In 2005, the Colonial/Cayegle escapement estimate was not available, and was therefore not included in the 14-stream index (Figure 2.20). From 2007 through 2013, a MR program was conducted on the Burman River in addition to the regular swim and foot surveys (Figure 2.21). The Burman River escapement estimate used for the 6-stream and 14-stream indices, however, is the swim and foot survey results instead of the MR estimates. The escapement indices in 2016 were 14,682 Chinook salmon for the 6-stream index and 22,244 for the 14-stream index (Appendix B5).

Over the last decade, the PSC Sentinel Stocks and Endowment Fund programs have conducted several studies aimed at producing high quality escapement estimates that are consistent with the CTC data quality standards (CTC 2013). In 2013 and 2014, Canadian Science Advisory

Process workshops were held with the objective of evaluating the escapement estimation methodology used to assess the abundance of WCVI indicator stocks. The reviews produced several recommendations for further work and potential improvements. It is anticipated that this work may eventually result in revised escapement data, with measures of precision, which are better quality than the estimates presented in Figure 2.20.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for these stocks (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Escapements have remained low at non-enhanced streams since 1999 despite terminal fishing restrictions in effect in Areas 24–26 from July to September each year. Escapement indices to all non-enhanced Clayoquot Sound and Kyuquot Sound Chinook salmon streams remain below 500 fish.

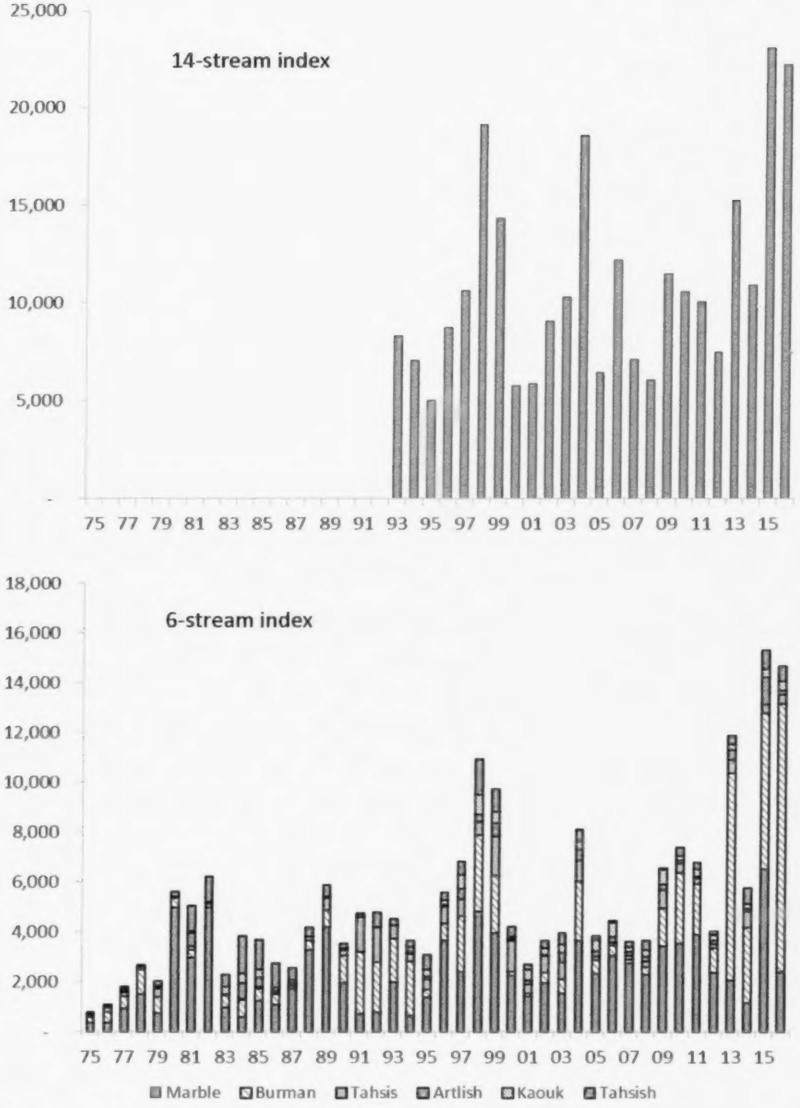


Figure 2.20.–WCVI 14-stream and 6-stream indices of escapement of Chinook salmon, 1975–2016.

Note: The escapement methodology changed for the 6-stream index in 1995 and prior estimates have not been calibrated to the new methodology.

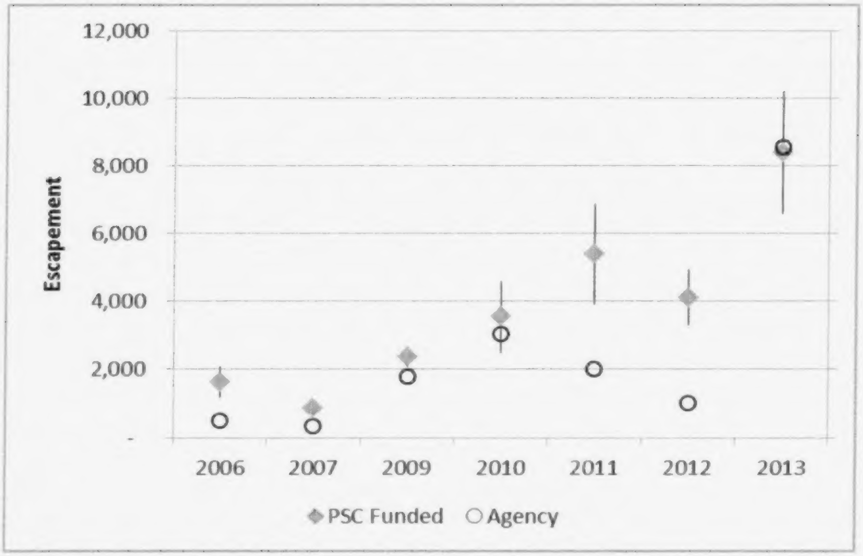


Figure 2.21.– Estimates of Burman River Chinook escapement in years when both agency swim surveys expanded by AUC methods were used (circles) and when mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with funding from the PST.

2.3.3.3.2 Upper Strait of Georgia

The Upper Strait of Georgia (UGS) stock index consists of five rivers (Klinaklini, Kakweiken, Wakeman, Kingcome, Nimpkish). Four rivers are in Johnstone Strait mainland inlets and the Nimpkish River is on northeast Vancouver Island. The estimated escapement for the UGS stock group in 2016 was 19,450 (Appendix Table B4; Figure 2.22).

Escapement Methodology: The accuracy of escapement estimates in the mainland inlet systems is poor, most likely due to low visibility of glacial systems, remote access, and timing of surveys. Furthermore, escapement estimates have primarily been based on aerial counts targeting other salmon species, which may not coincide with the main spawning period for Chinook salmon. Swim surveys and stream walks have been conducted in the Nimpkish River, and a fish wheel program occurred on Klinaklini River from 1997 to 2004. The escapement time series for the UGS stock includes estimates based on consistent methods within each river, and escapements to rivers missing escapement data for some years (i.e., no surveys) were estimated using the procedures described by English et al. (2007).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: Assessment of stock status is highly uncertain and the escapement time series requires standardization to better represent this stock group in the PSC Chinook model. Differences in ocean distributions, run timing, and life history indicate that future assessments should separate the stock group into conservation units.

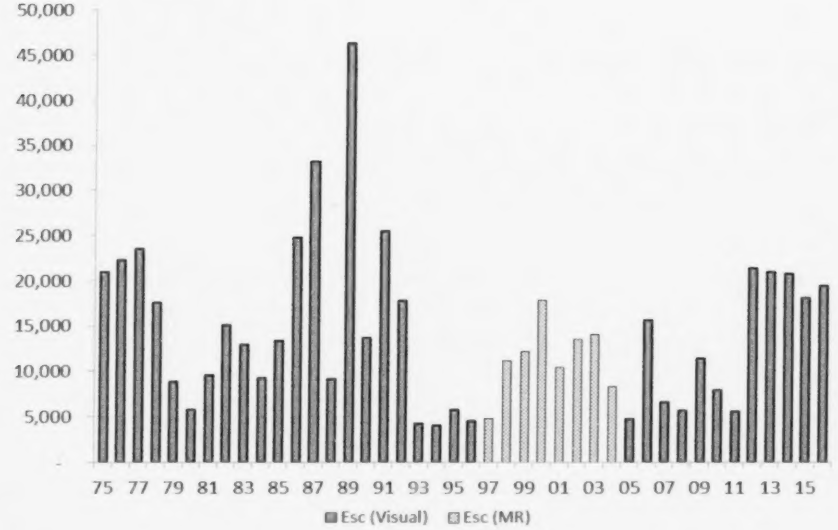


Figure 2.22.–Upper Georgia Strait stock group escapements of Chinook salmon, 1975–2016.

Note: The hatched bars in the histogram represent years when escapements to the Klinaklini River were estimated using Fishwheel mark–recapture methods while the solid bars indicate estimates based on visual surveys.

2.3.3.3.3 Lower Strait of Georgia

The Lower Strait of Georgia rivers monitored for naturally spawning fall Chinook salmon escapement are the Cowichan and Nanaimo rivers (Figure 2.23 and Figure 2.24). The estimated escapement in 2016 was 7,787 Chinook salmon for the Cowichan River and 1,982 for the Nanaimo River (Appendix Table B4).

Escapement Methodology: Total Chinook salmon returns have been estimated since 1975. Prior to 1988, escapement estimates from the Cowichan River were derived from swim and aerial surveys. This approach was also used for the Nanaimo River prior to 1995. Since 1988, a counting fence has been used in the Cowichan River. Between 1995 and 2004, carcass MR surveys were used in the Nanaimo River, and since 2005, AUC methods have been used. Survey life is based on a tagging study in 2006.

Escapement Goal Basis: An escapement goal of 6,500 (CV = 33%) for the Cowichan River was accepted by the CTC in 2005 (Tompkins et al. 2005). There is currently no CTC-accepted escapement goal for the Nanaimo River; however, there is a habitat-based estimate for S_{MSY} of 3,000 spawners (median; CV = 14%; Parken et al. 2006).

Agency Comments: The Cowichan River stock showed considerable increases in escapement in 1995 and 1996, followed by a rapid decline to conservation concern levels of more than 15% below the escapement goal. Significant Canadian fishery management actions have been used to reduce exploitation levels on the Lower Strait of Georgia natural stock group.

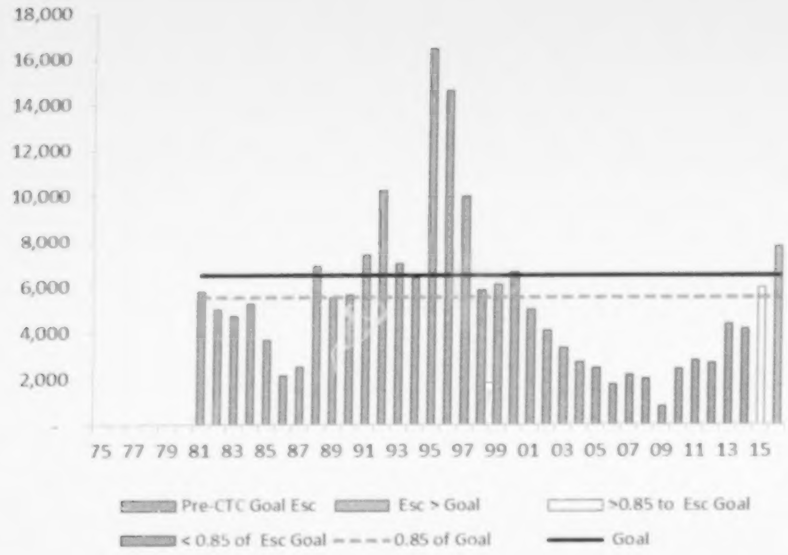


Figure 2.23.–Cowichan River escapements of Chinook salmon, 1981–2016.

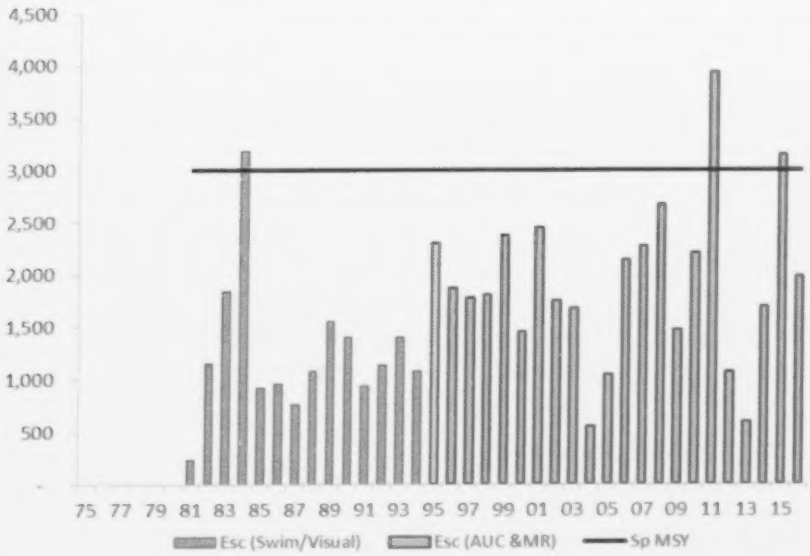


Figure 2.24.–Nanaimo River escapements of Chinook salmon, 1981–2016.

2.3.3.4 Fraser River Stocks

A large and diverse group of Chinook salmon spawning in Canada occurs in the Fraser River watershed, with many local populations (CTC 2002b; Candy et al. 2002).

Much of the knowledge about the status of Fraser Chinook salmon is based on spawner escapement data. Most data are from visual surveys, which are generally biased low, although many estimates are considered to be precise (Parken et al. 2003). Visual survey data are generated from aerial surveys and the escapement estimate is usually obtained by dividing the peak count by 0.65 (Farwell et al. 1999; Bailey et al. 2000). The CDFO continues to evaluate the accuracy of the peak count method through calibration studies, such as those funded by the PSC Endowment Fund programs. Escapement has been estimated at several locations using MR methods and direct counts at fishways or resistivity counters.

Currently, Fraser River Chinook are assessed as five stock groups for PSC management (Fraser Spring-Run 1.2, Fraser Spring-Run 1.3, Fraser Summer-Run 1.3, Fraser Summer-Run 0.3, and Fraser-Late), but are only represented by two stocks in the CTC Model (Fraser Early and Fraser Late). As part of the CTC Model Improvements program, the Fraser Early model stock is being separated into four model stocks to better represent population dynamics.

Within the Fraser, there are five current CWT-indicator stocks; Nicola River (Fraser Spring-Run 1.2), Lower Shuswap (Fraser Summer-Run 0.3), Middle Shuswap (Fraser Summer-Run 0.3), and Harrison River and Chilliwack River for Fraser Late. The Dome Creek CWT-indicator stock (Fraser Spring-Run 1.3) was discontinued in 2005.

Only the Harrison River has a CTC-approved escapement goal. For the remaining four stock groups, habitat-based models have been developed to estimate spawning capacity and the spawner abundance required to produce maximum sustained yield, S_{MSY} (Parken et al. 2006). In 2014, a Canadian Centre for Science Advice Pacific meeting examined the status and benchmarks for Southern BC Chinook conservation units (CUs), including Fraser. Benchmarks and status were accepted for non-enhanced CUs, but further work on enhanced CUs was necessary to evaluate status.

Escapements to the three stock groups with yearling smolt life history declined steeply from 2003 to 2009, and yearling smolts that entered the ocean in 2005 and 2007 experienced especially low survival. Recently, escapements have remained low, but with modest rebuilding brood over brood until 2016, when escapements to some of the stock groups failed to attain brood year levels. In contrast, escapements to the Fraser Summer-Run 0.3 increased during the 1990s and remained very abundant until 2012, when escapements were very low compared to levels observed over the previous decade.

For the Fraser late stock group, the Harrison River had very low escapements from 2012– 2014 with escapements more than 15% below the lower bound of the escapement goal (Figure 2.31). Escapement was estimated at 101,516 in 2015, which is higher than the 2014 escapement and just above the upper bound of the escapement goal. The 2016 escapement estimate is 41,327, which is much lower than the 2015 escapement and again, well below the lower bound of the escapement goal (Appendix Table B6).

2.3.3.4.1 Fraser River Spring Run: Age 1.3

The Fraser River spring run age-1.3 aggregate includes the Upper Pitt River and Birkenhead River populations in the Lower Fraser, spring-run populations of the Mid- and Upper Fraser, North Thompson, and South Thompson, but excludes the Lower Thompson tributaries (CTC 2002b).

Escapements are mostly estimated by expanded peak counts of spawners, holders and carcasses, surveyed from helicopters or on foot. Escapement decreased in 2016 from levels observed in 2015 and was estimated at 13,166, which was slightly higher than parental brood in 2011 (Figure 2.25).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods.

Agency Comments: The stock group has declined substantially over the last decade and is a stock of conservation concern.

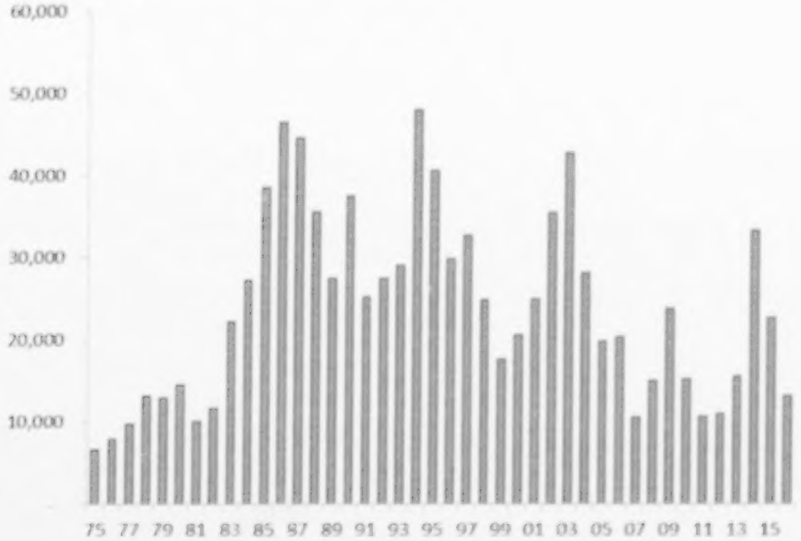


Figure 2.25.–Fraser River spring run age-1.3 stock group escapements of Chinook salmon, 1975–2016.

2.3.3.4.2 Fraser River Spring Run: Age 1.2

The Fraser Spring-run Age 1.2 stock group includes six smaller body size populations that spawn in the Lower Thompson River tributaries, Louis Creek of the North Thompson and the spring-run fish of Bessette Creek in the South Thompson (CTC 2002b). This stock group has an early maturation schedule for a stream-type life history, with an average generation time of 4.1 years (brood years 1985–1986), which results in smaller body size and lower fecundity compared to other stock groups.

Escapement Methodology: For the CTC time series, escapements are estimated visually using expanded peak counts of spawners, holders and carcasses in Spius Creek, Coldwater River, Louis Creek and Bessette Creek. Escapements to the Deadman River are estimated by resistivity counter and to the Nicola River by mark-recapture and calibrated visual surveys. Escapements decreased in 2016 from levels observed in 2015 and were estimated at 3,627, which was lower than parental brood escapement in 2012.

The Nicola River is the exploitation rate indicator stock for the Fraser Spring-run Age 1.2 stock group. Since 1995, high precision escapement estimates (by age and sex) have been generated using an MR program where Petersen disk tags are applied by angling and post-spawned salmon carcasses are examined for the presence of marks. Estimates of escapement have been generated using pooled Petersen methods. The expanded peak count time series for the Nicola River is generally less than the MR estimates (Parken et al. 2003); therefore, the Nicola peak count series has been calibrated to the mark-recapture data and is used prior to 1995 in the Fraser Spring-run Age 1.2 aggregate time series (Figure 2.26 and Figure 2.27).

The MR estimated escapement of 2,180 in 2016 is lower than levels observed in 2015 and represents 63% of the 2012 parental brood. Since 1995 hatchery origin fish have averaged 24% of the spawning escapement (range: 4%–62%).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this aggregate. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and electronic resistivity counter methods. Since 2004, the Nicola River escapements have been less than the median estimate of S_{MSY} (9,300; CV 21%).

Agency Comments: The stock group has declined substantially over the last decade and is a stock of conservation concern.

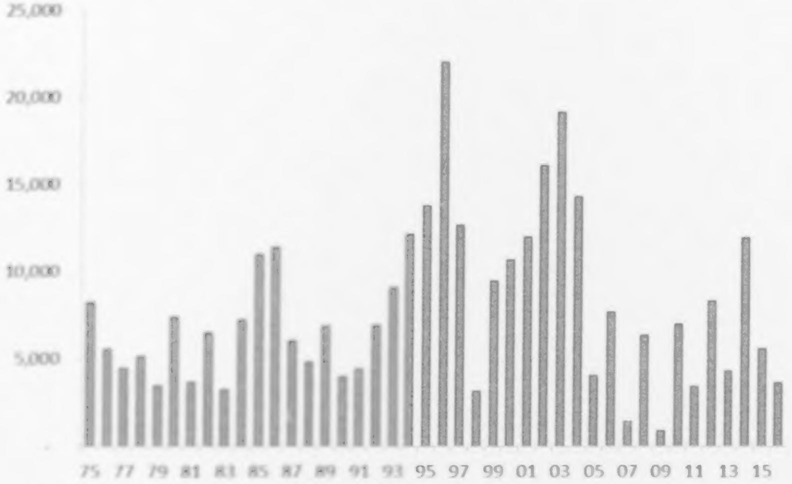


Figure 2.26.–Fraser River spring run age-1.2 stock group escapements of Chinook salmon, 1975–2016.

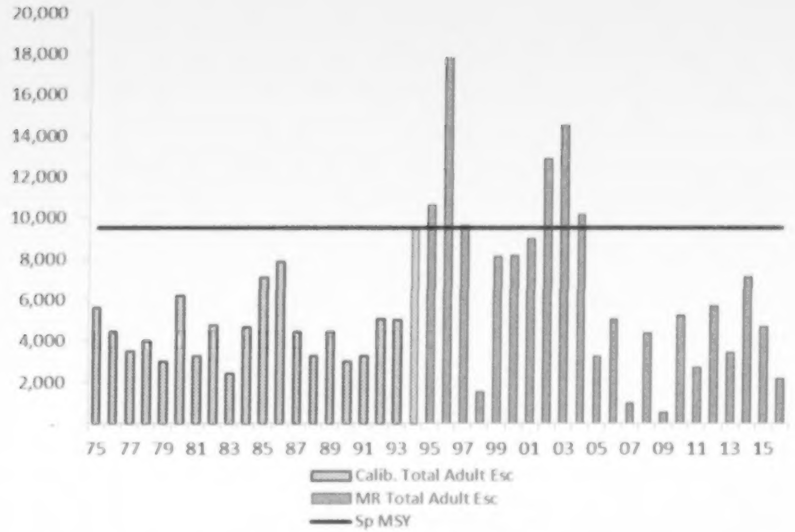


Figure 2.27.–Nicola River escapements of Chinook salmon, 1975–2016.

2.3.3.4.3 Fraser River Summer Run: Age 1.3

The Fraser River summer run age-1.3 aggregate includes 10 populations spawning in large rivers, mostly below the outlets of large lakes. These include the Nechako, Chilko, and Quesnel rivers in the Mid-Fraser and the Clearwater River in North Thompson watershed (CTC 2002b). The aggregate escapement was estimated at 9,269 in 2016, which is substantially lower from those observed in 2015 and parental brood. This is one of the lowest escapements on record for this aggregate (Figure 2.28).

Escapement Methodology: Escapements are estimated by expanded peak counts of spawners, holders and carcasses surveyed from helicopters. Surveys of the Stuart River and North Thompson River were discontinued in 2004 due to unreliable counting conditions.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate. Habitat-based estimates of S_{MSY} and other stock–recruitment reference points are available for this stock group, but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR and AUC methods.

Agency Comments: The stock group declined over the last decade and, while there is evidence that the decline may have ended, the stock has not rebuilt and remains a stock of conservation concern.

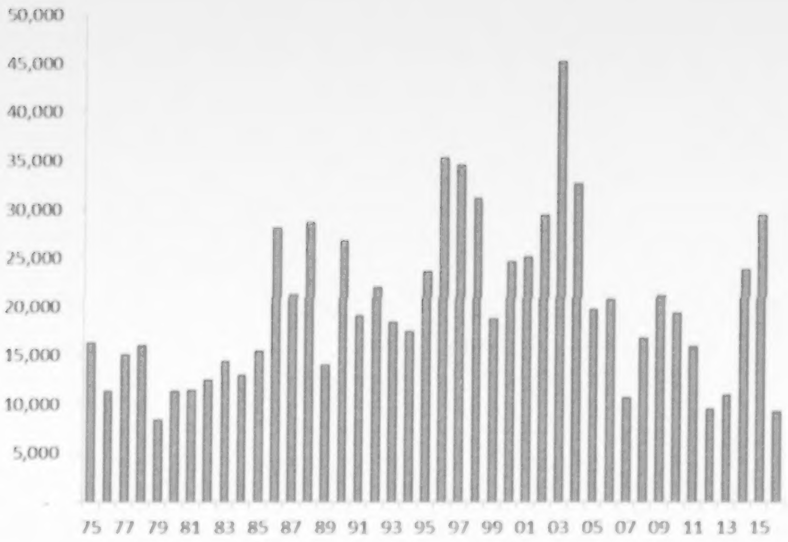


Figure 2.28.–Fraser River summer run age-1.3 stock group escapements of Chinook salmon, 1975–2016.

2.3.3.4.4 Fraser River Summer Run: Age 0.3

The Fraser Summer-Run Age 0.3 aggregate includes six populations spawning in the South Thompson watershed and one in the lower Fraser. These include the Middle Shuswap, Lower Shuswap, Lower Adams, Little River and the South Thompson River mainstem, in the BC interior, and Maria Slough in the lower Fraser (CTC 2002b). Escapements to stock group were low in 2016, although there was some variation within the stocks in the aggregate. Escapements were estimated at 93,175 in 2016 (Figure 2.29).

Escapement Methodology: Escapements are estimated using peak count visual survey and mark-recapture methods.

Since 2000 (with the exception of 2003), the Lower Shuswap River has been an exploitation rate indicator stock for the Fraser Summer-run Age 0.3 stock group, and an MR program provides high precision estimates of escapement by age and sex. Tags have been applied to live fish by seining and salmon carcasses were examined later for the presence of marks. In addition, there are multiple years of MR data for the Middle Shuswap River. The estimated escapement for Lower Shuswap in 2016 was 6,438 which is higher than the very low parental brood. Since 2000, hatchery-origin fish averaged 11% of the escapement (range: 4%-22%; Figure 2.30).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for the aggregate. Habitat-based estimates of S_{MSY} and other stock-recruitment reference points are available for this stock group (Parken et al. 2006), but estimates of total escapement are needed to make them effective. Work is currently underway to estimate total escapements by developing factors that calibrate the visual survey indices to total escapements estimated by MR methods and novel methods developed during the Sentinel Stocks Program. Peak count estimates for the

Lower Shuswap River from 1975 to 1999, and for 2003 have been calibrated to mark-recapture equivalents. In the past two decades, with the exception of 2012 and 2016, Lower Shuswap River escapements have exceeded the median estimate of S_{MSY} (12,800; CV=37%).

Agency Comments: Escapements had been increasing for this stock group over the last decade and the stock group has been healthy and abundant, with the exception of the 2012 and 2016 escapement (the progeny of the 2012 brood year escapement).

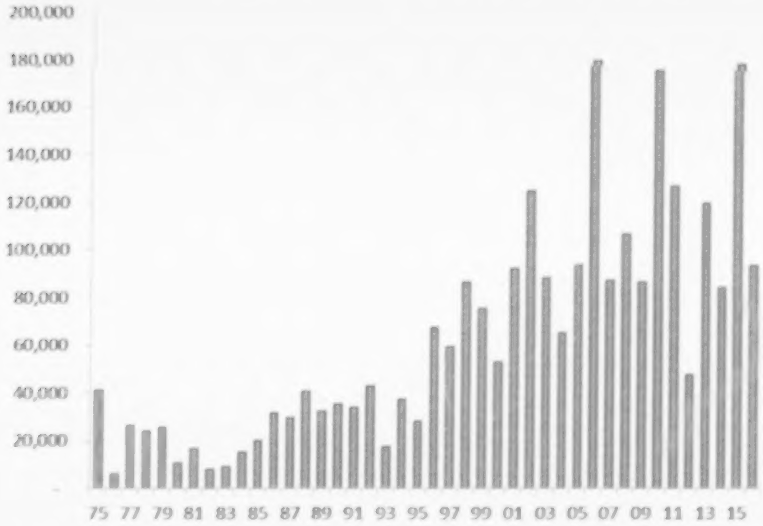


Figure 2.29.–Fraser River summer run age-0.3 stock group escapements of Chinook salmon, 1975–2016.

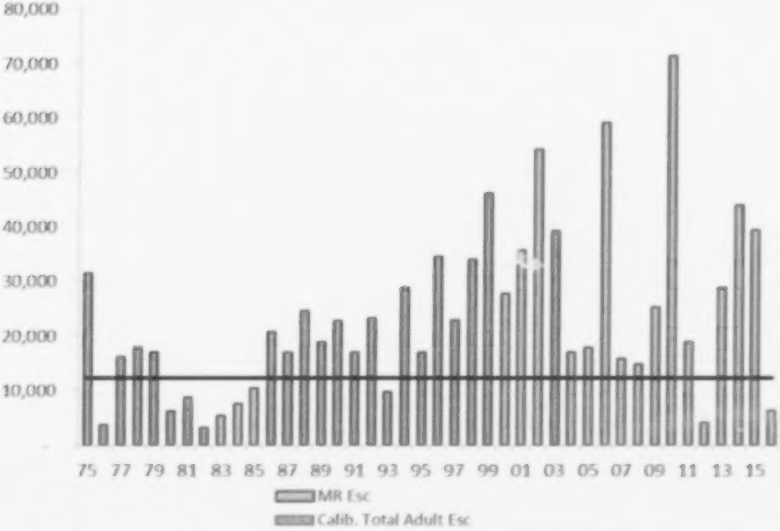


Figure 2.30.–Lower Shuswap River escapements of Chinook salmon, 1975–2016. The visual escapement estimates have been calibrated with the mark–recapture estimates.

2.3.3.4.5 Fraser River Late Run (Harrison River)

Harrison River Chinook salmon are white-fleshed fish that return to spawn during the fall. They are unusual in that the fry migrate into the lower Fraser River and estuary shortly after emergence. This stock spends 2-4 years in the coastal marine environment before returning to spawn. The Harrison River stock is one of the largest naturally spawning Chinook salmon populations in the world and makes important contributions to fisheries in southern BC, and Washington State. Spawning escapements to the Harrison River have varied widely from a low of 28,616 adults in 1995 to a high of 246,984 adults in 2003. Escapements were more than 15% below the lower bound of the escapement goal from 2012–2014 and again in 2016, with an estimated escapement of 41,327 adult Chinook salmon (Figure 2.31).

Escapement Methodology: Since 1984, MR studies have been conducted annually on the Harrison River to obtain reliable estimates of spawning escapements.

Escapement Goal Basis: Due to their natural abundance and importance in numerous British Columbia and Washington State fisheries, Harrison River Chinook salmon were designated as an escapement indicator stock (i.e., 'key stream' indicator) to aid in fulfilling commitments under the 1985 Pacific Salmon Treaty. In 1986, an interim escapement goal for Harrison River Chinook salmon was established at 241,700 fish, based on doubling of the escapement estimate obtained from a MR program in 1984. In 2001, an escapement goal range was developed for Harrison Chinook salmon using a Ricker stock-recruit approach (CTC 2002b). The escapement goal range that was proposed was 75,100–98,500 (CV=15%) with the upper bound equal to the upper 75% confidence limit derived from a bootstrap procedure. This range was reviewed and accepted by the CTC. Estimated spawning escapements in the Harrison have exceeded this escapement goal range in fourteen years from 1984 to the present. Escapements have fluctuated substantially with no apparent trend in the time series, until the recent period of poor returns. Average contribution of enhanced fish is 4%.

Agency Comments: The stock has become a conservation concern due its low escapement over four of the past five years relative to the escapement goal.

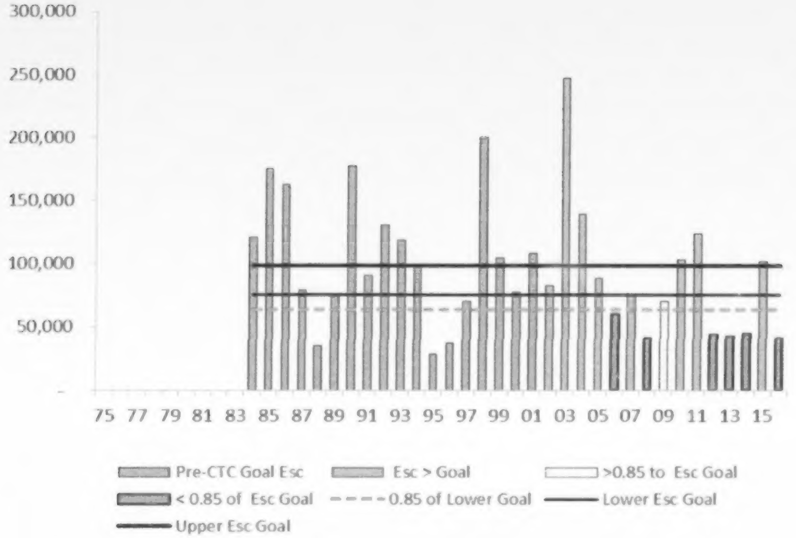


Figure 2.31.–Harrison River escapements of Chinook salmon, 1984–2016.

2.3.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

The PSC escapement indicator stocks in Washington and Oregon are currently separated into four regional groups: Puget Sound, Washington Coastal, Columbia River, and North Oregon Coastal. Far north migrating Chinook salmon from the mid-Oregon Coast are currently being incorporated in the PSC Chinook model in this year's base period recalibration. There are currently no CTC-agreed escapement indicator stocks for the Mid-Oregon Coastal group, although there have been two proposed (the South Umpqua and Coquille). The indicator stocks include a variety of run timings and ocean distributions.

Biologically based escapement goals have been reviewed and accepted by the CTC for four fall stocks (Queets, Quillayute, Hoh, and Grays Harbor) and two spring/summer stocks (Queets and Hoh) in coastal Washington, four Columbia River stocks (Lewis, Upriver Brights, Deschutes, and Mid-Columbia Summers), and three far north migrating Oregon coastal stocks (Nehalem, Siletz, and Siuslaw).

2.3.4.1 Puget Sound

Puget Sound escapement indicator stocks include spring, summer/fall and fall Chinook salmon stocks from the Nooksack, Skagit, Stillaguamish, Snohomish, Lake Washington, and Green river systems. They tend to have a more local distribution than most coastal and Columbia River stocks and are caught primarily in WCVI AABM fisheries, and Canadian and US ISBM fisheries. Escapement for these stocks is defined as the total number of natural- and hatchery-origin fish spawning naturally on the spawning grounds.

2.3.4.1.1 Nooksack River

The Nooksack River drains into Puget Sound just north of Bellingham. The Nooksack spring Chinook salmon stock includes early-timed populations returning to the North and South fork of the Nooksack River.

Escapement Methodology: Estimates of the spring run type escapement in the South Fork have traditionally been based on the number of redds observed prior to the first of October expanded by 2.5 spawners per redd. Since 1999, this estimate has been refined using CWTs, adipose fin clips, and thermal otolith marks to estimate the number of hatchery origin strays, and subsequently natural origin fish, in the spawning populations. A more recent refinement has been to use micro-satellite DNA to assign fish sampled through the first week of October to geographic and run type origin, i.e., North and Middle Fork, South Fork, or hatchery, and spring or fall run type. The majority of the run and the escapement to the spawning grounds is composed of hatchery-origin returns from two supplementation programs. Owing to the influence of glacial runoff, estimates of escapement in the North and Middle Forks are based on a combination of field methods, including carcass and redd counts (i.e., in clear tributaries and during clear/low-flow mainstem conditions). Due to spawn timing differences, North and Middle Fork escapement estimates are assumed to be spring Chinook salmon only. The proportions hatchery origin fish are calculated from the number of fish identifiable to origin out of the total observed during carcasses sampling.). In 2014, the estimate of total escapement was 1,606, with 91 natural-origin spawners in the North and Middle Fork and 78 natural-origin fish in the South Fork (22 SF origin and 56 NF/MF origin). The preliminary 2015 estimate of total spawners is 1,852, with 401 natural-origin spawners in the North and Middle Fork and 46 natural-origin spawners in the South Fork (7 SF origin and 39 NF/MF (Figure 2.31). Escapement estimates are not yet available for either population for 2016.

Starting with the 2008 return year and ending with 2014 return year, WDFW undertook a study that used transgenerational genetic mark-recapture (tGMR) methods to estimate spawning escapement of spring Chinook. Among the results of the tGMR study was a finding that escapement estimates calculated from by tGMR techniques ranged from 1.2 to 3.1 times higher than escapement estimated obtained from carcass and redd count data (Figure 2.33). These results are consistent with tGMR studies conducted with Stillaguamish River Fall Chinook because the tGMR estimates will include fish from the entire river basin, rather than expansions of sampled reaches that may incomplete by not incorporating all spawning areas. The co-managers are currently reviewing results of the tGMR study, investigating analytical techniques that would adjust estimates calculated from field sampling data to a tGMR equivalent estimate that would more appropriately incorporate un-sampled areas.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal escapement goal established for this Chinook salmon management unit is an upper management threshold (UMT) of 4,000 spawners and a low abundance threshold (LAT) of 2,000 natural-origin fish (CCMP 2010). The UMT established by the state–tribal managers is generally considered as the adult (age 3+) escapement level associated with maximum sustained harvest. The LAT is the escapement level below which dramatic declines in long-term productivity could occur. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.

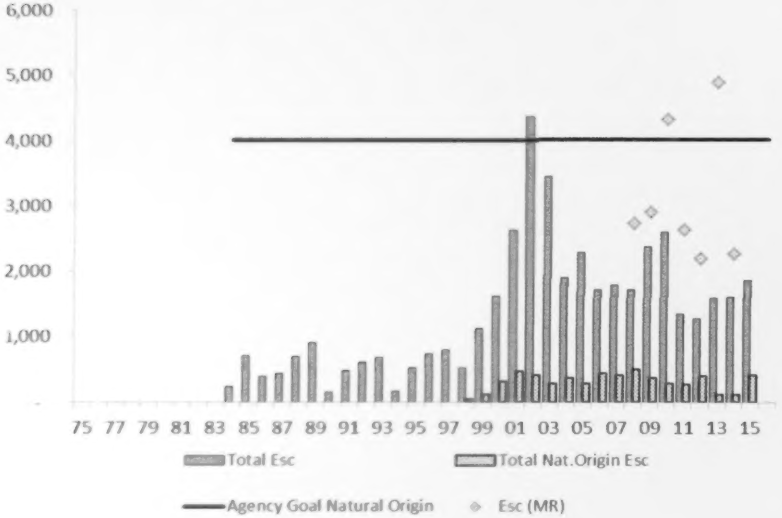


Figure 2.32.–Nooksack River escapement of total (natural- and hatchery-origin) and natural-origin spring Chinook salmon, 1984–2015.

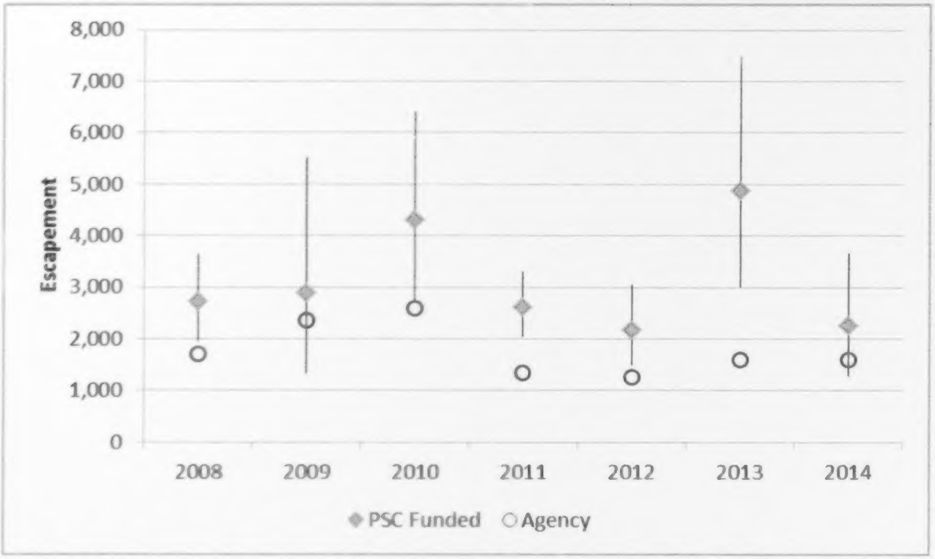


Figure 2.33.–Nooksack River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when transgenerational genetic mark–recapture (tGMR) estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Treaty-related funding.

2.3.4.1.2 Skagit River Spring

cumulative redds are counted in the mainstem upstream of river mile 8.1 to the forks at 18.6 in the lower north fork and south fork, and in Found, Kindy, and Marble Creeks. In the Upper Sauk, cumulative redd counts are conducted from river mile 31.0 to 39.7 (Cascade below White Chuck river mouth to the confluence of the North and South Fork Sauk), in the North Fork Sauk from the mouth to the falls river mile 1.6 to 41.3 of the Sauk River, and in the South Fork Sauk, river mile 0 to 5.0 (South Fork). In the Suiattle basin, cumulative redds are counted in mainstem Suiattle, and in Big, Tenas, Straight, Circle, Buck, Lime, Downey, Sulphur, and Milk creeks. Escapement may include very small numbers of hatchery strays in these natural production areas. Past PSC-funded studies on straying of Marblemount Hatchery spring Chinook salmon focused on the area immediately adjacent to the hatchery which is outside the survey reach for natural production. All natural production areas for Spring Chinook are surveyed, hence escapement from the above areas are summed to arrive at the total. The preliminary 2016 escapement estimate is 2,429 natural spawners (Figure 2.34).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The current UMT used by the state and tribal co-managers for the Skagit River spring Chinook salmon management unit is 2,000 with a LAT of 576 (CCMP 2010). Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a total exploitation rate ceiling rather than for a UMT or LAT escapement.

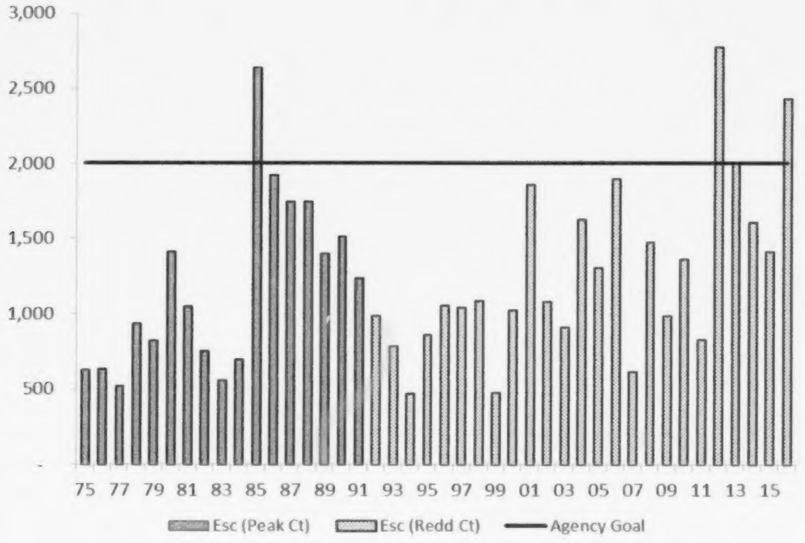


Figure 2.34.–Skagit River escapement of spring Chinook salmon to the spawning grounds, 1975–2016.

Note: This includes early-timed populations returning to the Upper Sauk, Cascade, and Suiattle rivers.

2.3.4.1.3 Skagit River Summer/Fall

The Skagit River summer/fall Chinook salmon stock includes the Upper Skagit River summer, Sauk summer, and Lower Skagit River fall run populations.

Escapement Methodology: Escapement of Skagit River summer/fall Chinook salmon was estimated using expansion of redd counts from helicopter surveys of mainstem areas and foot surveys of smaller tributaries. The counts are expanded by the AUC method (Smith and Castle 1994). This method assumes a 21-day redd life and 2.5 adult spawners for each estimated redd. Natural escapement is predominantly offspring from natural-origin parent spawners; the remainder are hatchery-origin fish from the wild stock tagging program that started in 1994. Natural escapement does not include the brood stock collected for this program. The preliminary 2016 escapement estimate is 16,761 natural spawners (Figure 2.35).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: The UMT used by the state–tribal comanagers for the Skagit River summer/fall Chinook salmon management unit is 14,500, based on a recent assessment of freshwater productivity and accounting for variability and biases in management error (CCMP 2010). The LAT is 4,800 spawners. Since its listing as threatened under the ESA in 1999, annual fishery management for this stock has been for a total exploitation rate rather than for a UMT or LAT escapement. In years when the UMT is expected to be exceeded, terminal fisheries can be expanded subject to the overall ceiling exploitation rate.

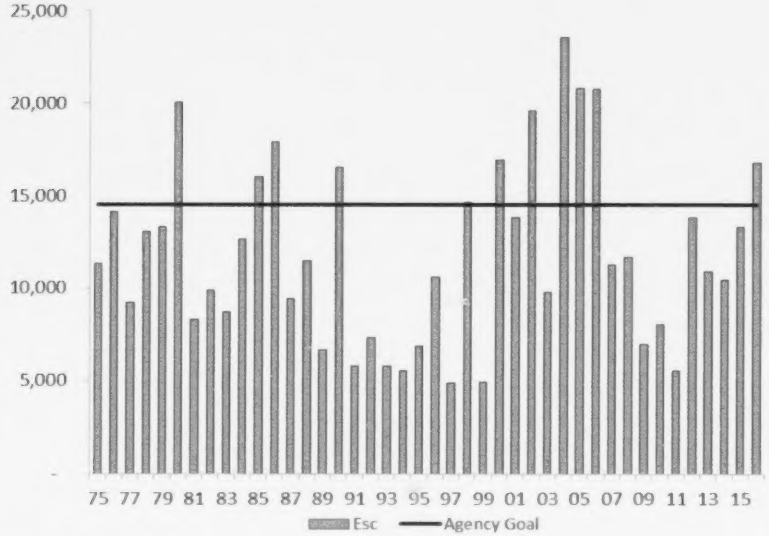


Figure 2.35.–Skagit River escapement of summer/fall Chinook salmon to the spawning grounds, 1975–2016.

2.3.4.1.4 Stillaguamish River

The Stillaguamish River drains into northern Puget Sound between Everett and Mount Vernon. The Stillaguamish River has two populations of Chinook salmon distinguished by genetic characteristics—a summer-timed run and a fall-timed run. These two populations overlap in spawn timing and distribution with both populations spawning in both forks of the river. The summer-timed run is a composite of natural- and hatchery-origin supplemental production, with the majority of spawning occurring in the North Fork and its major tributaries, including Boulder River, and Deer, Grant, French, and Squire Creeks. A much smaller, natural-origin fall stock spawns primarily in the mainstem and South Fork Stillaguamish; in Pilchuck, Jim, and Canyon Creeks; and in the North Fork Stillaguamish. Escapement is currently estimated as South Fork and North Fork Stillaguamish rather than summer and fall populations of Chinook salmon.

Escapement Methodology Escapement estimates for Stillaguamish Chinook salmon were based on redd count expansions, assuming a 21-day redd life. The North Fork of the Stillaguamish River is surveyed more extensively with one to three aerial surveys and AUC redd estimates. The escapement estimates for the south fork of the Stillaguamish River uses a peak redd count and assumes 2.5 fish per redd. Boulder and Squire Creeks on the North Fork Stillaguamish River and Jim Creek on the South Fork Stillaguamish River are also surveyed. Spawning escapement estimates of fall Chinook salmon may be biased low due to incomplete redd counts using visual sampling methods (Figure 2.36). Evidence of this is supported by tGMR studies in 2008 through 2015 funded through Treaty-related sources where escapement estimates were 0.97 times to 1.61 times higher than those calculated from redd count data (Figure 2.37). Natural escapement excludes brood stock taken for the wild stock indicator program after 1987, but does include spawning hatchery fish from this production. Total natural spawning escapement in 2016 is estimated at 844. An additional 76 natural-origin and 65 hatchery-origin fish were collected for broodstock from the spawning grounds.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: State–tribal co-managers have established a UMT for this management unit of 900 natural-origin spawners (600 from the North Fork of the Stillaguamish River and 300 from the South Fork of the Stillaguamish River and mainstem) with an LAT of 700 (CCMP 2010). The summer Chinook salmon supplementation program, which collects brood stock from the North Fork of the Stillaguamish River return, was initiated in 1986 as a PST indicator stock program, and its current objective is to release 200,000 tagged fingerling smolts per year. Since 2000, an average of approximately 140 adults have been collected annually from the spawning population for this program. Most releases into the North Fork are from acclimation sites. Relatively small numbers of smolts have been released into the South Fork of the Stillaguamish River. Since listing as threatened under the ESA in 1999, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement.

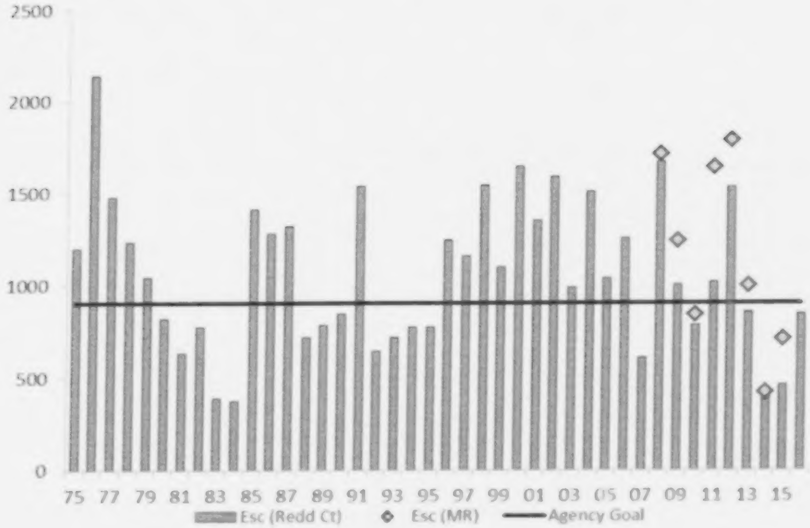


Figure 2.36.–Stillaguamish River escapement of Chinook salmon to the spawning grounds, 1975–2016.

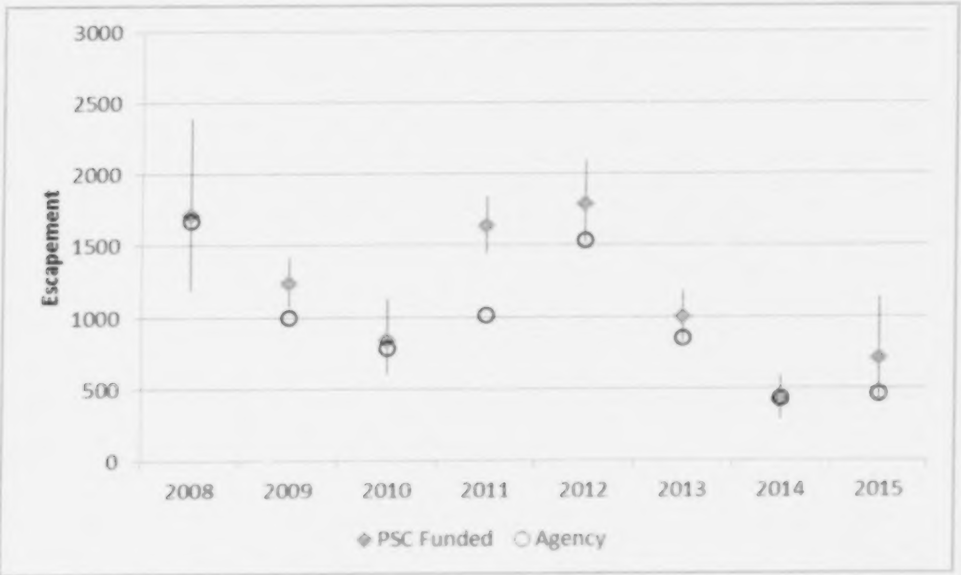


Figure 2.37.–Stillaguamish River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when transgenerational genetic mark–recapture (tGMR) estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Treaty-related funding.

2.3.4.1.5 Snohomish River

The Snohomish River is located in northern Puget Sound near Everett. The Snohomish Chinook salmon stock includes the Skykomish and Snoqualmie summer/fall run populations. Skykomish Chinook salmon spawn in the mainstem of the Skykomish River and its tributaries—including the Wallace and Sultan rivers, Bridal Veil Creek, the south fork of the Skykomish River between river mile 49.6 and river mile 51.1, above Sunset Falls (fish have been transported around the falls since 1958), and the North Fork of the Skykomish River up to Bear Creek Falls (river mile 13.1). Snoqualmie Chinook salmon spawn in the Snoqualmie River and its tributaries, including the Tolt River, Raging River, and Tokul Creek.

Escapement Methodology: Escapement was estimated using expansion of redd counts conducted by a combination of helicopter, float, and foot surveys, and from fish counts at the Sunset Falls fishway. The natural escapement estimate includes a significant contribution of hatchery strays from the Wallace and Bernie Kai-Kai Gobin (Tulalip Tribe) facilities. Annual tGMR studies funded under the SSP were conducted from 2011–2014 (Figure 2.38 and Figure 2.39). The 2016 escapement is estimated at 5,153 natural spawners using redd counts.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal co-managers have a UMT for this stock of 4,600 natural-origin spawners (CCMP 2010). The LAT for Snohomish River summer/fall Chinook salmon is 2,800. Since listing as threatened under the ESA in 1999, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement. In 2014, WDFW and the Tulalip Tribe reviewed, reconciled, and updated the historic escapement time series for the Snohomish Basin; this resulted in minor changes to the data series.

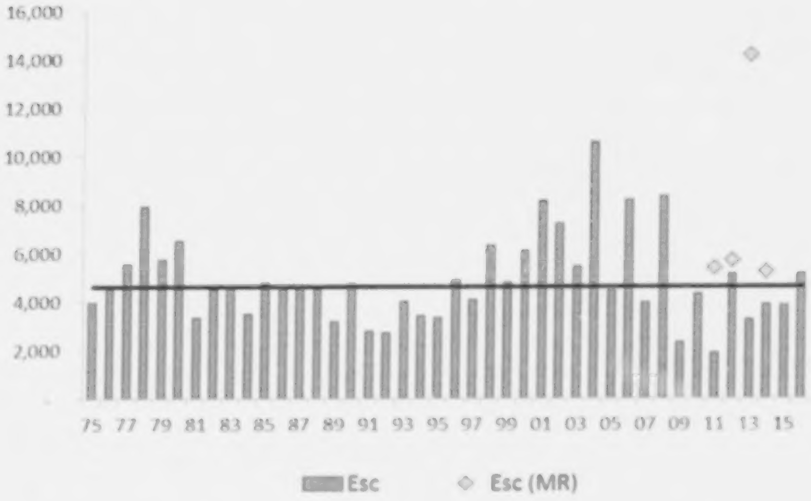


Figure 2.38.–Snohomish River escapement of Chinook salmon to the spawning grounds, 1975–2016.

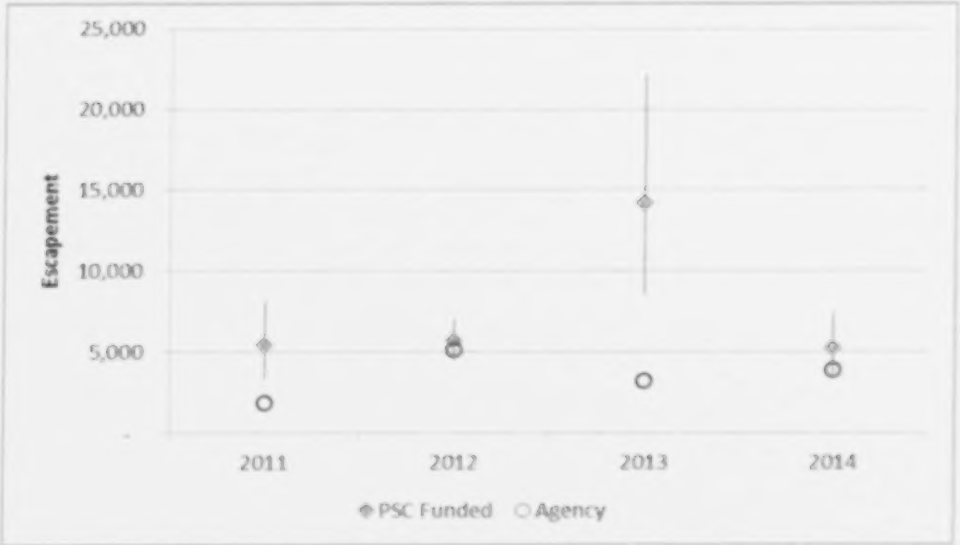


Figure 2.39.–Snohomish River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when transgenerational genetic mark–recapture (tGMR) estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Treaty-related funding.

2.3.4.1.6 Lake Washington

The Lake Washington Chinook salmon stock includes the fall run populations in the Cedar River and in the north Lake Washington tributaries of Bear, Cottage, and Issaquah Creeks. A hatchery is located on Issaquah Creek, and Chinook salmon spawning in there are not included in the natural escapement for Lake Washington.

Escapement Methodology: Escapement in the mainstem Cedar River is estimated using expansion of total redd counts. Prior to 1999, live counts and AUC methods were used to estimate spawning abundance in the Cedar. Past AUC estimates have been converted to redd-based estimates using simple linear regression. Escapement estimates are considered a complete census because redd surveys cover the entire Chinook production area of the Cedar River. It should be noted that although there are no hatchery fish released into the Cedar River, an average of 23% of the spawners from 2003 to 2008 were adipose clipped from mass-marked hatchery production, presumably from Issaquah Hatchery (CCMP 2010). Escapement to tributaries in north Lake Washington is estimated using live counts and AUC methods in Bear and Cottage Lake Creeks. Index surveys in Bear Creek began in 1981; index surveys in lower Cottage Lake Creek began in 1983, and were expanded in 1997 to include upper Cottage Lake Creek (considered a nonindex area). Past AUC estimates of index areas have been converted to AUC estimates of both index and nonindex area using simple linear regression. The majority of natural spawners in Bear and Cottage Lake Creeks are hatchery-origin fish, likely strays from the Issaquah hatchery. The 2016 naturally spawning escapement estimate for Lake Washington is 1,217; 1,025 in the Cedar River and 262 (of which 68 were natural-origin fish) in Bear and Cottage Lake Creeks (Figure 2.40).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: A state–tribal interim UMT escapement goal of 1,200 Chinook salmon for an index reach in the Cedar River was established in 1993 based on average escapements from 1965 to 1969. This goal for the index reach was converted to 1,680 Chinook salmon for the entirety of the river downstream of the dam and reflects a redd-based escapement value consistent with the interim escapement goal derived using AUC methodology. Since listing in 1999 as threatened under the ESA, annual fishery management for this stock has been for a ceiling exploitation rate rather than for a UMT or LAT escapement in the Cedar River; however, when the UMT is expected to be exceeded, some additional fishing in Lake Washington is considered.

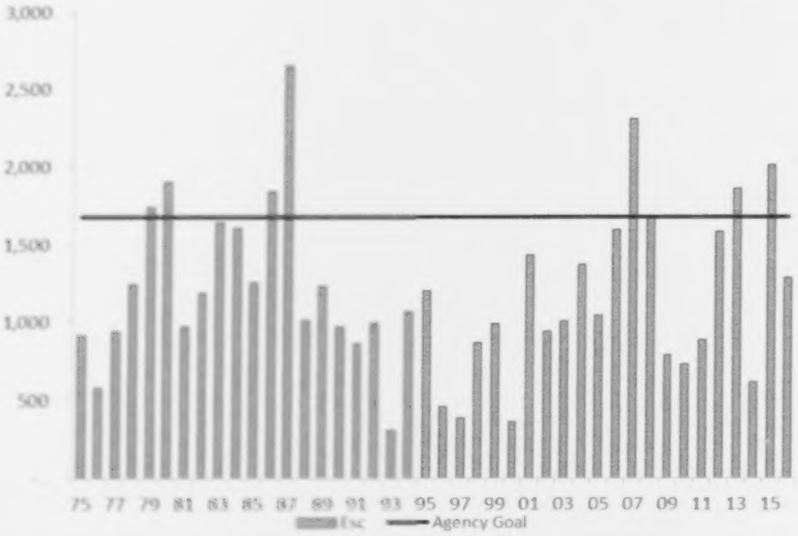


Figure 2.40.–Escapement of Chinook salmon to the spawning grounds in the tributaries of Lake Washington (Cedar River and Bear and Cottage Lake Creeks), 1975–2016.

2.3.4.1.7 Green River

The Green River fall Chinook salmon stock consists of a single population spawning in the mainstem Green River and two of its major tributaries, Newaukum and Soos creeks.

Escapement Methodology: Escapement is estimated from a redd count expansion method that has varied over the time series by the extent of spawning survey coverage. The method used until about 1996 involved an index area redd count multiplied by 2.6 to estimate total redds, then multiplied by 2.5 fish per redd to produce estimated escapement. The 2.6 index to total redd expansion factor was based on a 1976 to 1977 US Fish and Wildlife Service MR study (Ames and Phinney 1977).. Since 1996, the survey areas have broadened and the associated expansion factor of 2.6 has been reduced to the point that the redd counts in 2009 have complete spawning reach coverage. The method used in recent years provides natural escapement estimates for the mainstem Green River and Newaukum Creek. Newaukum Creek redds are counted during foot surveys. The mainstem Green River is surveyed by boat and by air. Some parts of the river (i.e., the Gorge) are only surveyed by air. Boat surveys are generally done once a week, or twice a week in years with a large numbers of pink salmon. One aerial survey is made during the peak of spawning, more if budgets permit. Certain index reaches of the river are surveyed every week by boat to develop a cumulative redd count total for those reaches. These index reaches are distributed throughout the river. Visible redds are counted for the entire floatable part of the river by boat each week and for the entire river by helicopter during the peak. The ratio of visible redds seen by boat to those seen by air (boat surveys assumed to be best) is used to estimate how many redds would be seen by boat in the unfloated reaches. This provides an estimate of how many visible redds exist during the peak of spawning. To get from peak redds to cumulative total redds, the visible redds in the index reaches during the peak are compared to the season total for those index reaches. Different areas of the river have different ratios of peak visible redds to season totals. Expansion of nonindex visible redds to season total redds uses the ratio from nearby index reaches of the same general character. The CTC considers these estimates from redd counts as index values rather than estimates of total escapement. Estimates of total escapement from MR studies in 2000, 2001, and 2002 funded through the US Letter of Agreement were about 2.5 times higher than the escapement estimate from redd count expansion. In 2010, 2011 and 2012, tGMR based escapements from studies funded under the SSP were once again more than twice as high as the redd count expansion estimates (Figure 2.41 and Figure 2.42). There is a large hatchery program in this basin and these fish comprise a large portion of the return. Hatchery fish contribution to the natural escapement ranged from 53% to 65% for the years 2004 to 2007. The 2016 redd-based estimate of naturally spawning escapement is 10,063 mixed hatchery- and natural-origin Chinook salmon.

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal UMT escapement goal of 5,800 naturally spawning adults is the average of the 1965 to 1976 escapements (Ames and Phinney 1977). The LAT is 1,800 fish. Since its listing as threatened under the ESA in 1999, annual fishery management for this stock has been a ceiling exploitation rate in the southern US preterminal fisheries, and a UMT in the terminal fisheries.

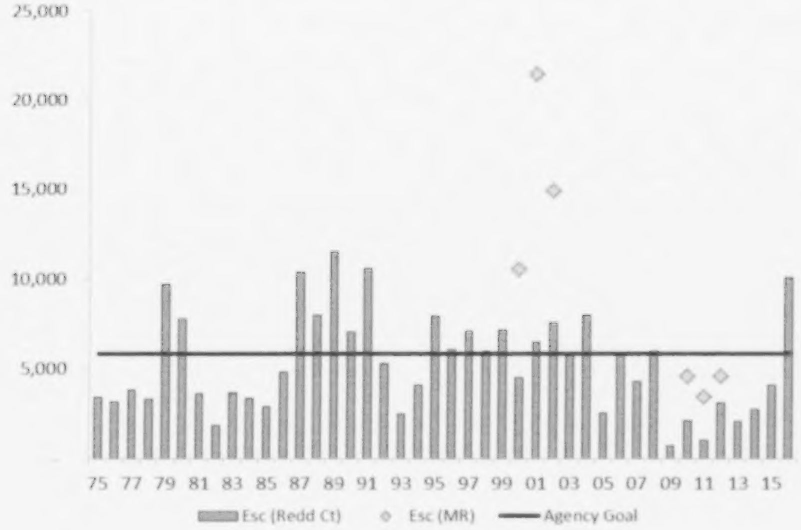


Figure 2.41.–Green River escapement of Chinook salmon to the spawning grounds, 1975–2016.

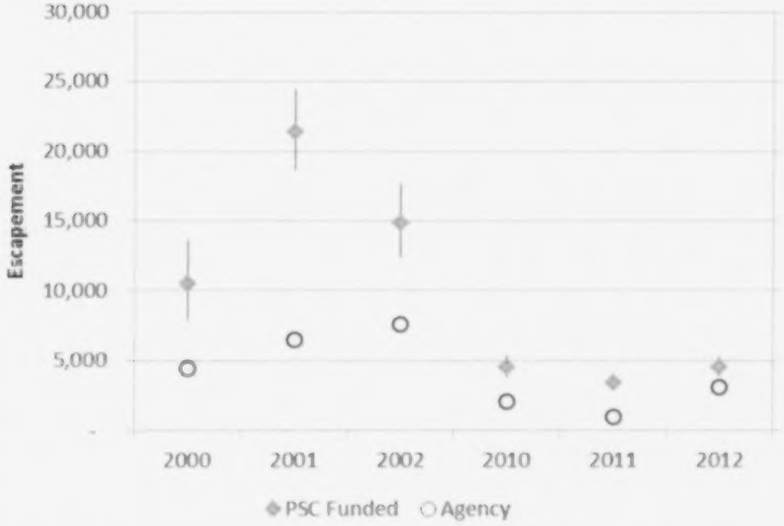


Figure 2.42.– Green River escapements of Chinook salmon to the spawning grounds in years when both agency expanded redd counts were used (circles) and when conventional (2001–2002) and genetic (2010–2012) mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Letter of Agreement or SSP funding.

2.3.4.2 Coastal Washington

Coastal Washington stocks include spring, summer, and fall Chinook salmon from the Hoko, Quillayute, Hoh, and Queets rivers, and from Grays Harbor. Coastal Washington stocks have a northerly distribution and are vulnerable to southern US fisheries primarily as mature fish during their spawning migrations. They are caught primarily in SEAK and NBC AABM fisheries and in terminal net fisheries.

2.3.4.2.1 Hoko River

The Hoko River is located at the extreme western end of the Strait of Juan de Fuca and is not a population listed under the ESA as part of the Puget Sound Chinook Salmon Endangered Species Unit. Hoko River Chinook salmon spawn primarily in the mainstem of the Hoko River, with limited spawning in larger tributaries.

Escapement Methodology: The Makah Tribe and WDFW conduct ground surveys using cumulative redd counts for the mainstem (Hoko) and tributaries found between river mile 1.5 and 21.7, which represents the entire range of spawning habitat utilized by Chinook salmon. Redd counts are multiplied by 2.5 adults per redd. There are 10 mainstem reaches plus 13 tributary reaches, including Little Hoko, Browne's, Herman, North Fork Herman, Ellis, Bear, and Cub Rivers, which are all upper mainstem tributaries. The tribe also surveys the mainstem Sekiu River; and Carpenter, South Fork Carpenter, Sunnybrook, and unnamed Creeks 19.0215, 19.0216, and 19.0218. Escapement excludes brood stock collected from the spawning grounds for the supplementation program which started in 1988 and has collected an average of 188 fish annually through 2015. In 2016, 230 fish were retained for the supplementation program leaving a total natural spawning escapement estimate of 965 mixed natural-and hatchery-origin returns from the supplementation program (Figure 2.43).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The UMT escapement goal established by state and tribal co-managers is 850 naturally spawning adults The escapement goal was calculated using a habitat-based approach (rather than a stock–recruitment analysis) by estimating the amount of available spawning habitat, then expanded utilizing assumed optimal redds per mile and fish per redd values (Ames and Phinney 1977).

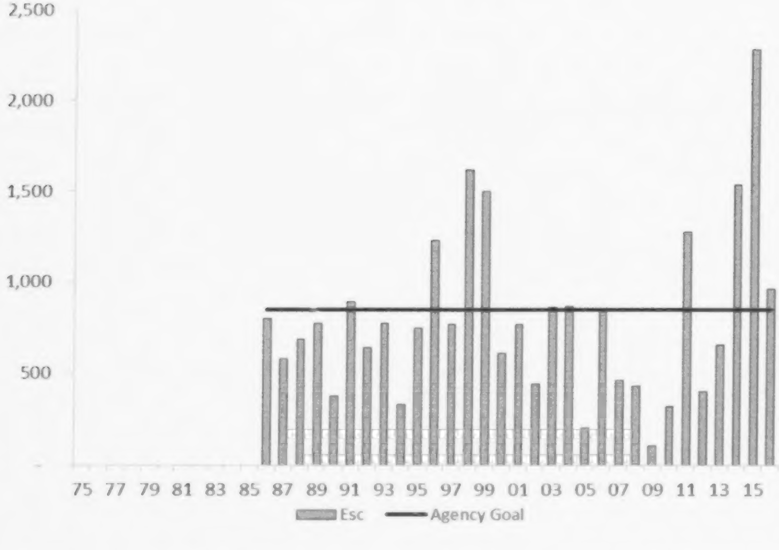


Figure 2.43.–Hoko River escapement of Chinook salmon to the spawning grounds, 1986–2016.

2.3.4.2.2 Quillayute River Summer

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, mainstem Calawah, North Fork Calawah, and Sitkum Rivers. This has been used consistently in the Quillayute River System since the 1970s. Surveys are conducted by foot, raft, drift boat, and helicopter, and index areas are surveyed either weekly or biweekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other unsurveyed streams and segments with historical fish presence. These areas comprise the Quillayute River system stream mileage base that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2016 escapement estimate for summer Chinook salmon was 871 (Figure 2.44).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock.

Agency Comments: The state–tribal management goal for this stock is 1,200 adults and jacks combined (PFMC 2003).

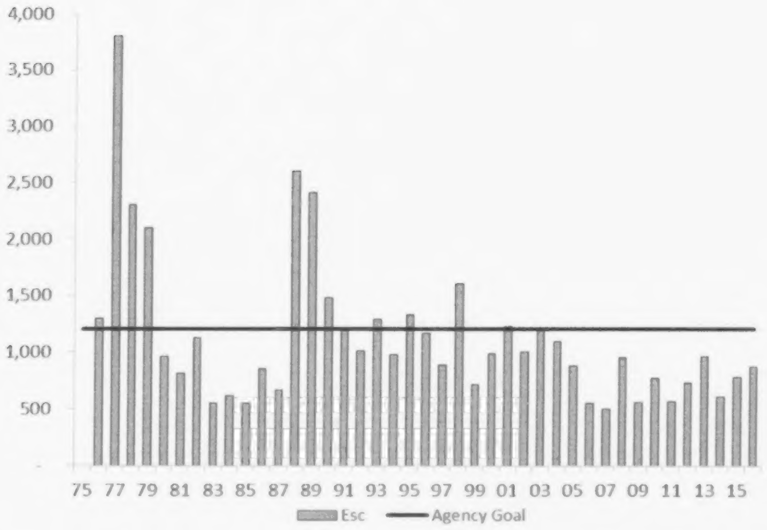


Figure 2.44.–Quillayute River escapement of summer Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.3 Quillayute River Fall

The Quillayute River drains from the northwest side of the Olympic Mountains into the Pacific Ocean, south of Cape Alava on the north Washington coast. It is one of four Washington coast river systems that contain fall Chinook salmon with CTC-accepted escapement goals.

Escapement Methodology: Escapement estimates are based on redd counts in index areas and from supplemental surveys on the Bogachiel, Sol Duc, Dickey, Calawah rivers and several other smaller tributaries in the basin. This has been used consistently in the Quillayute River System since the 1970s. Surveys are conducted by foot, raft, drift boat, and helicopter, and index areas are surveyed either weekly or biweekly as conditions allow. Supplemental surveys are done once a season during the peak spawning period. Redd counts from these supplemental surveys are then expanded by the index surveys to estimate redd construction within the supplemental survey areas for the entire season. Using an appropriate redds per mile assignment, the information from index and supplemental surveys is then applied to other streams and segments that have historically had fish presence, but were not surveyed. These areas comprise the Quillayute River system stream mileage base that is consistently calculated to estimate escapement numbers. The number of redds is multiplied by 2.5 to estimate fish escapement. The 2016 escapement estimate was 3,654 (Figure 2.45).

Escapement Goal Basis: In 2004, the CTC-accepted an escapement goal for Quillayute fall Chinook salmon of 3,000 natural spawners based on a spawner–recruit analysis developed by QDNR (1982) and Cooney (1984).

Agency Comments: Terminal fisheries are managed for a harvest rate of 40%, with an escapement floor of 3,000 fish. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

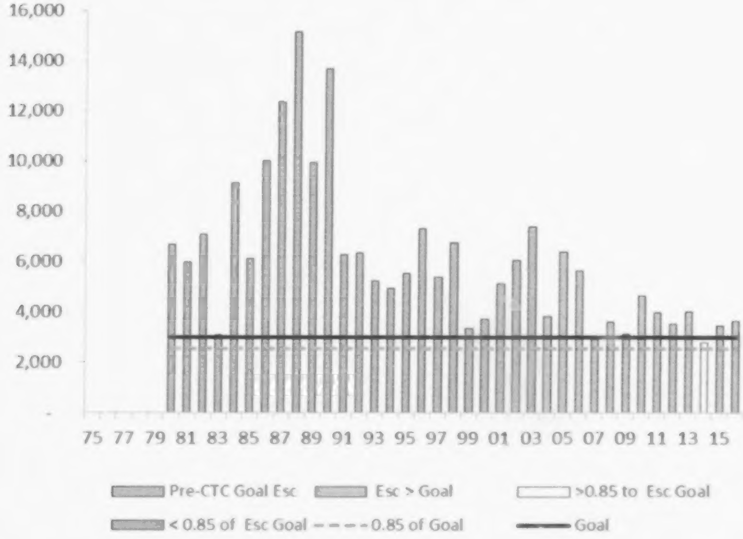


Figure 2.45.–Quillayute River escapement of fall Chinook salmon to the spawning grounds, 1980–2016.

2.3.4.2.4 Hoh River Spring/Summer

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south.

Escapement Methodology: Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork of the Hoh River, and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record new and visible redds. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Surveys are also conducted in reaches too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity, and spawner abundance estimates are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish per redd. There is no hatchery program in this system. The 2016 natural escapement estimate was 1,241 fish (Figure 2.46).

Escapement Goal Basis: Escapement floor policy of 900 for the Hoh spring/summer Chinook salmon was developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses, and was accepted by the CTC in 2004. Stock production analysis of spawning escapement for brood years 1969 to 1976 was utilized to determine the initial escapement floor.

Agency Comments: Similar to many of the other Washington coastal stocks, Hoh River spring/summer escapements have been relatively stable except for much larger returns in 1988, 1989, and 1990. The terminal return for this stock declined from 1997 to 2000, had rebounded in 2001 before declining again since 2005. Terminal fisheries are managed to catch 31% of the river run, with an escapement floor of 900 fish. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

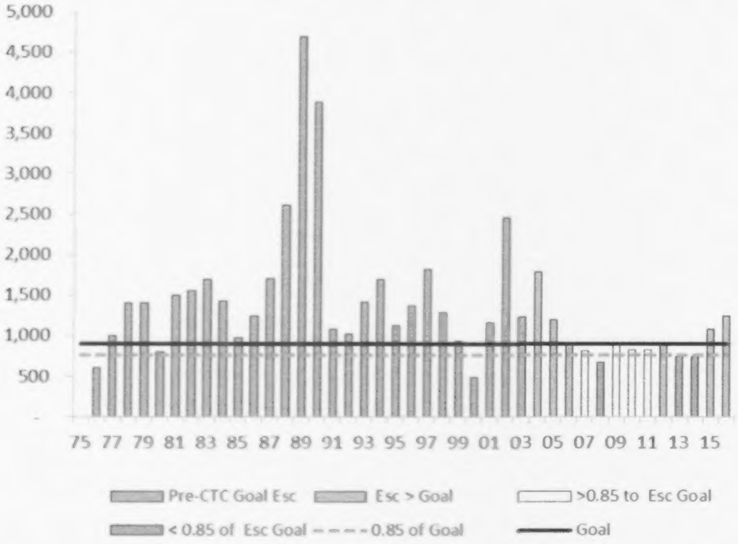


Figure 2.46.–Hoh River escapement of spring/summer Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.5 Hoh River Fall

The Hoh River drains from the western side of the Olympic Mountains on the north Washington coast between the Quillayute River to the north and the Queets River to the south. It is one of four Washington coast river systems that contain fall Chinook salmon with CTC-accepted escapement goals.

Escapement Methodology: Escapement is estimated from redd counts in index areas, supplemental surveys in the mainstem and south fork Hoh River, and in tributaries with spawning habitat. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted infrequently in additional monitored stream areas utilized by spawning Chinook salmon. These reaches encompass areas too large or remote to intensively monitor throughout the season. Surveys are timed as close as possible to peak spawning activity. Spawner abundance estimates from the extensive surveys are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated assuming 2.5 fish per redd. The natural escapement estimates for Hoh River fall Chinook include a small number of fish taken for an experimental hatchery program from 1983 to 1986, but otherwise should be considered natural-origin fish. The 2016 escapement estimate is 2,831 fish (Figure 2.47).

Escapement Goal Basis: The escapement floor of 1,200 for the Hoh fall Chinook salmon was developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses, and was accepted by the CTC in 2004 as the escapement goal. Stock production analyses of spawning escapements from 1968 to 1982 were utilized to determine the initial escapement floor.

Agency Comments: The state–tribal management plan for this stock includes a harvest rate of 40% of the terminal run, with an escapement floor of 1,200 spawners. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

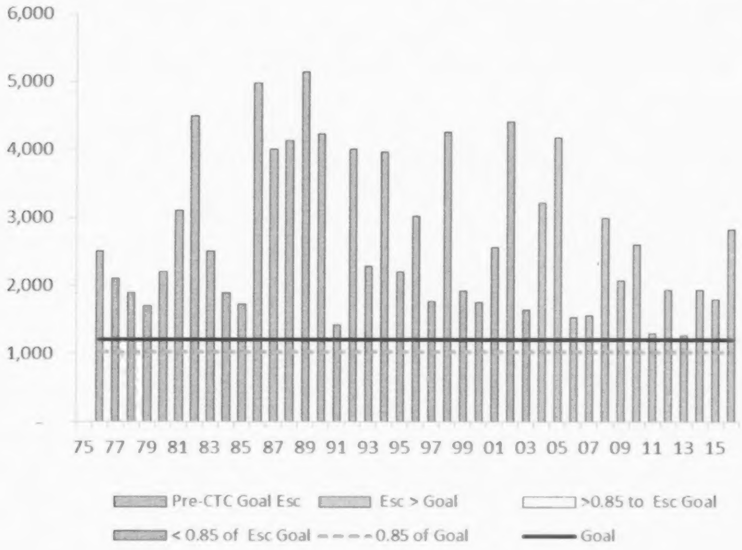


Figure 2.47.–Hoh River escapement of fall Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.6 Queets River Spring/Summer

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River.

Escapement Methodology: Escapement is estimated from redd counts from August 15 to October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed each week. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive surveys are also conducted infrequently in additional monitored stream areas utilized by spawning Chinook salmon. These reaches encompass areas too large or remote to intensively monitor throughout the season and the surveys are timed as close as possible to peak spawning activity. Spawner abundance estimates from the extensive surveys are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 2.5 fish per redd. The 2016 estimate of natural escapement was 704 fish (Figure 2.48).

Escapement Goal Basis: Escapement floor policy of 700 for Queets spring/summer Chinook salmon was developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses, and was accepted by the CTC in 2004 as the escapement goal. Stock production analysis of spawning escapements for brood years 1969 to 1976 were used to determine the initial escapement floor.

Agency Comments: Terminal fisheries are managed by the state and tribes to catch 30% of the river run size, with an escapement floor of 700 fish. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock. Since 1990, terminal fisheries directed on this stock have been limited, as returns to the river have rarely exceeded the escapement floor. Since 2000, sport anglers have been required to release all Chinook salmon during the summer, and tribal fisheries have been limited to one tribal netting day for ceremonial and subsistence purposes.

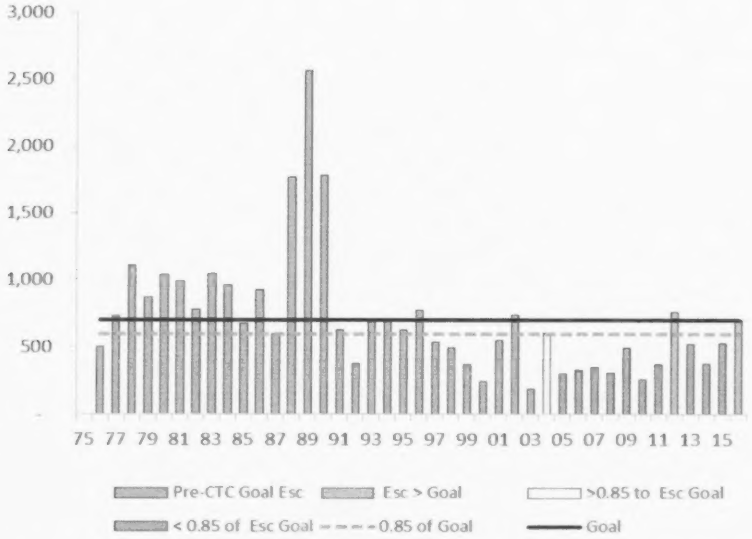


Figure 2.48.–Queets River escapement of spring/summer Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.7 Queets River Fall

The Queets River drains from the western side of the Olympic Mountains on the north Washington coast and is south of the Hoh River. It is one of four Washington coast river systems that contain fall Chinook salmon with CTC-accepted escapement goals.

Escapement Methodology: Escapement is estimated from redd counts from October 15 to December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive Surveys are also conducted infrequently in additional monitored stream areas used by spawning Chinook salmon that are too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity. Spawner abundance estimates from these larger areas are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 2.5 fish per redd. The 2016 estimate of Queets River fall Chinook salmon natural escapement was 2,915 (Figure 2.49).

Escapement Goal Basis: Escapement Goal Basis: The escapement floor policy of 2,500 for the Queets fall Chinook salmon was developed by QDNR (1982) and Cooney (1984) based on spawner–recruit analyses, and was accepted by the CTC in 2004 as the escapement goal. Stock production analyses of spawning escapements from 1967 to 1982 were used to determine the initial escapement floor.

Agency Comments: Terminal fisheries are managed by the state and tribes to catch 40% of the river return, with an escapement floor of 2,500 spawners. This objective was designed to allow a wide range of spawner escapements from which to eventually develop an MSY objective or proxy while protecting the long-term productivity of the stock.

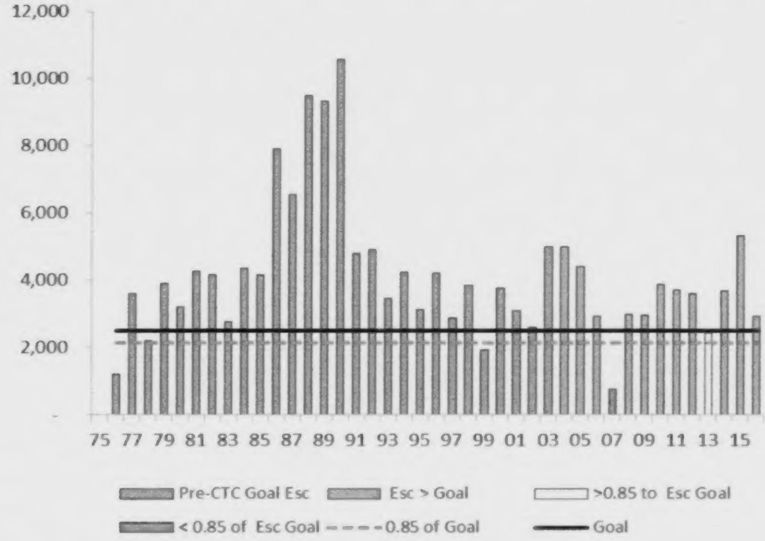


Figure 2.49.–Queets River escapement of fall Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.8 Grays Harbor Spring

Grays Harbor spring Chinook salmon spawn primarily in the upper reaches of the mainstem Chehalis River and its tributaries.

Escapement Methodology: Escapement is estimated by redd counts from August 15 to October 15 for spring/summer Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed. Cumulative redd counts for each index reach represent the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive Surveys are also conducted infrequently in additional monitored stream areas used by spawning Chinook salmon that are too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity. Spawner abundance estimates from these larger areas are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 2.5 fish per redd. The 2016 escapement was 926 Chinook salmon (Figure 2.50).

Escapement Goal Basis: There is currently no CTC-accepted escapement goal for this stock group.

Agency Comments: The natural spawning escapement goal established by the state–tribal co-managers for Grays Harbor spring Chinook salmon is 1,400 adult fish (PFMC 2003). This single targeted goal was developed as a MSY proxy. This objective was derived from actual spawning data from the mid- to late 1970s, and expanded to include additional habitat not covered by spawner surveys.

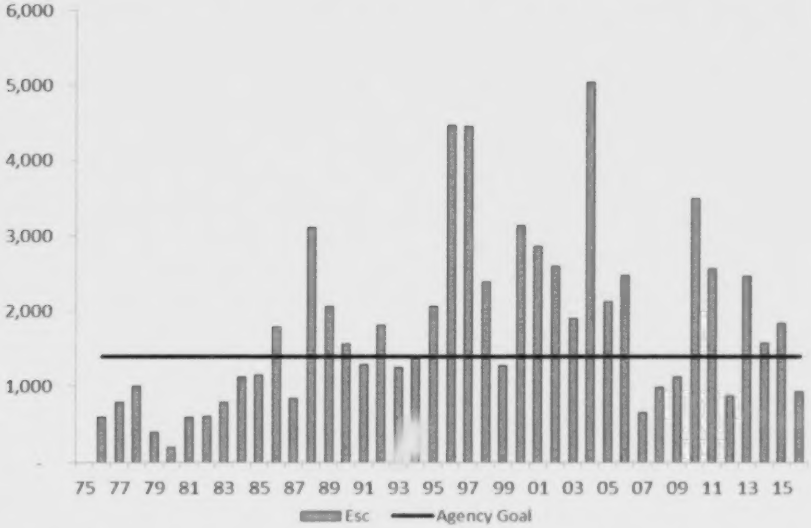


Figure 2.50.–Grays Harbor escapement of spring Chinook salmon to the spawning grounds, 1976–2016.

2.3.4.2.9 Grays Harbor Fall

Grays Harbor fall Chinook salmon spawn primarily in the mainstem Chehalis River, in the Humptulips and Satsop rivers where fall Chinook salmon hatchery facilities are located, and in smaller tributaries such as the Wishkah and Hoquiam rivers that flow directly into the harbor. The Grays Harbor fall Chinook stock is one of four Coastal Washington fall Chinook stocks that have CTC-accepted escapement goals.

Escapement Methodology: Escapement is estimated from redd counts from October 15 to December 1 for fall Chinook salmon. Surveys are conducted by foot, boat, and helicopter. Intensively monitored index reaches are surveyed weekly to record total new and visible redds observed. Cumulative redd counts for each index reach represents the total spawner abundance for that particular spawning area. Weekly visible redd counts in index reaches are used to estimate spawning timing curves by calculating the proportion of season cumulative redds that are visible on each weekly survey date. Extensive Surveys are also conducted infrequently in additional monitored stream areas used by spawning Chinook salmon that are too large or remote to intensively monitor throughout the season. These surveys are timed as close as possible to peak spawning activity. Spawner abundance estimates from these larger areas are derived using index timing curves. For areas with suitable habitat but not regularly surveyed, redd densities (cumulative redds per river mile) from surveyed reaches with similar habitat type are used to estimate escapement into these reaches of known stream length. The total natural spawning escapement is calculated under the assumption of 2.5 fish per redd. The 2016 escapement was 11,685 spawners (Figure 2.51).

Escapement Goal Basis: In 2014, the CTC accepted an escapement goal for Grays Harbor fall Chinook salmon of 13,326 natural spawners based on a spawner-recruit analysis developed by QDNR and WDFW (2014).

Agency Comments: Consistent with the stock group in Attachments I, II, and V of the 2009 Agreement, the Grays Harbor fall Chinook salmon escapement goal will be applied in CTC stock-performance evaluations on a stock aggregate basis. This goal, however, is the sum of tributary-specific goals that were derived separately for the Chehalis and Humptulips rivers.

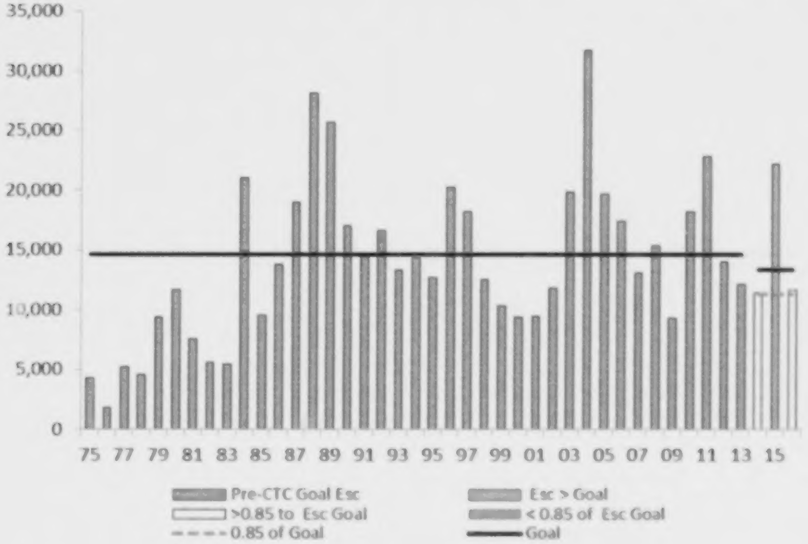


Figure 2.51.–Grays Harbor escapement of fall Chinook salmon to the spawning grounds, 1976–2016.

Note: The displayed agency goal line (14,600) relates to the agency goal in effect through 2013; the recently CTC-accepted escapement goal (13,326) will be used in assessments from 2014 onward.

2.3.4.3 Columbia River

Columbia River stocks include spring, summer, and fall run Chinook salmon from the Columbia River and its tributaries. Runs may have different marine distributions with different vulnerabilities to ocean fisheries. Upriver spring stocks generally migrate offshore and are rarely retained in ocean salmon fisheries. As a result, they are not identified in Attachments I–V of the PST. Most summer and fall stocks have a northern distribution, and are caught in SEAK and WCVI AABM fisheries, and in US ISBM fisheries. Lower Columbia River tule fall Chinook salmon have a more local distribution and are caught mainly in the WCVI AABM fishery and US ISBM fisheries.

2.3.4.3.1 Columbia Upriver Spring

Escapement Methodology: To provide consistency with the *US v. Oregon* Technical Advisory Committee's annual Joint Staffs Reports, escapement graphs include the estimated sum of wild adult upper Columbia spring Chinook salmon passing Rock Island Dam (Joint Columbia River Management Staff 2013, Table 8) and wild adult Snake River spring/summer Chinook salmon passing Lower Granite Dam (plus Tucannon escapements below; Joint Columbia River Management Staff, Table 9). However, for purposes of fishery management and allocation under *US v. Oregon*, Columbia Upriver spring stock includes all hatchery and wild fish destined to return past Bonneville from January 1 through June 15. There are additional tributary spawning escapements (e.g., Deschutes and John Day rivers) that comprise the Columbia Upriver spring management unit that are not included in the graph. Although it is not a completely comprehensive estimate of the naturally spawning Columbia Upriver spring escapement past Bonneville, this times series provides a consistent and annually documented index of the abundance trend of naturally spawning fish (Figure 2.52). Escapements decreased in 2016 for the third year in a row.

Escapement Goal Basis: Under the 2008–2017 *US v. Oregon Management Agreement*, this stock is not managed for an escapement goal. Fishery impacts are managed using harvest rate schedules based on total river mouth abundance of upriver spring Chinook salmon or the Snake River natural spring/summer run size if it is less than 10% of the total run size (2008–2017 *US v. Oregon Management Agreement*, Appendix A, Table A1). The harvest rate schedule ranges from less than 5.5% at run sizes less than 27,000 up to 17% at run sizes exceeding 488,000.

Agency Comments: The 2008–2017 *US v. Oregon Management Agreement* provides for a minimum annual mainstem treaty Indian ceremonial and subsistence entitlement of 10,000 spring and summer Chinook salmon. Beginning in 2010, modifications to Table A1 (2008–2017 *US v. Oregon Management Agreement*) were implemented requiring Southern US nontreaty fisheries to meet catch balancing provisions for upriver spring Chinook salmon. Under these provisions, Southern US nontreaty fisheries are managed to remain within ESA impacts, and to not exceed the total allowable catch available for treaty Indian fisheries.

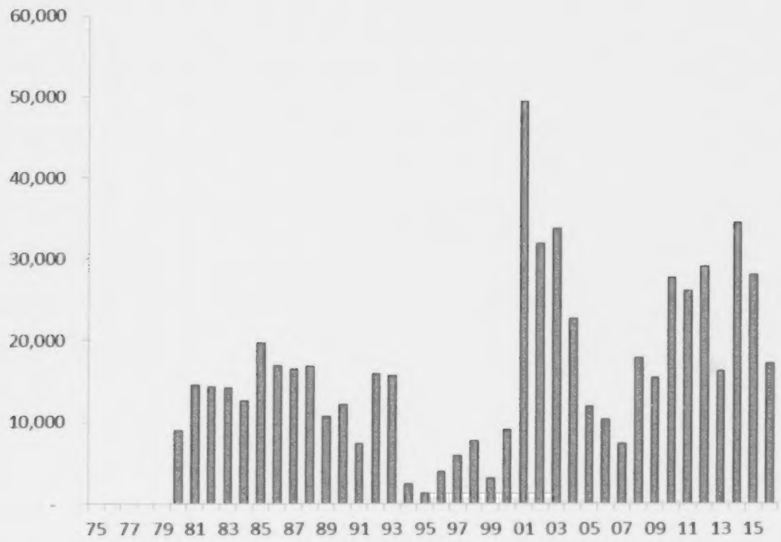


Figure 2.52.–Escapement of Columbia upriver spring Chinook salmon, 1980–2016.

2.3.4.3.2 Mid-Columbia Summer

Escapement Methodology: The estimated count of adult Chinook salmon passing Rock Island Dam between June 18 and August 17 are graphed in Figure 2.53; these counts include hatchery fish, but are more consistent with the model data (hatchery and wild combined) used to develop the interim escapement goal. The Rock Island Dam counts have been robust in recent years.

Escapement Goal Basis: The CTC (1999) developed an interim escapement goal of 12,143 adult summer Chinook salmon past Rock Island Dam, using PSC Chinook model predictions of escapement and recruitment. A 2008 analysis of actual escapement data resulted in a higher estimate, but the CTC requested the addition of even more years of data, rather than accepting the proposed goal. Therefore, the interim goal remains.

Agency Comments: The summer management period is from June 16 to July 31. Catches of Chinook salmon during this period are in accord with a harvest rate schedule that varies based on expected river mouth abundance (2008–2017 *US v. Oregon Management Agreement*, Table A2). Harvest rates vary from about 5% to 7% for run sizes up to 16,000, 15% to 17% for run sizes up to 36,250, and are based on catch sharing formulas for harvestable surpluses beyond that run size. In addition, Mid-Columbia summer Chinook salmon are managed for a goal of 29,000 hatchery- and natural-origin adults at the Columbia River mouth, to provide 20,000 adults above Priest Rapids Dam, including 13,500 Wenatchee/Entiat/Chelan natural fish, 3,500 Methow/Okanogan natural fish and 3,000 hatchery fish.

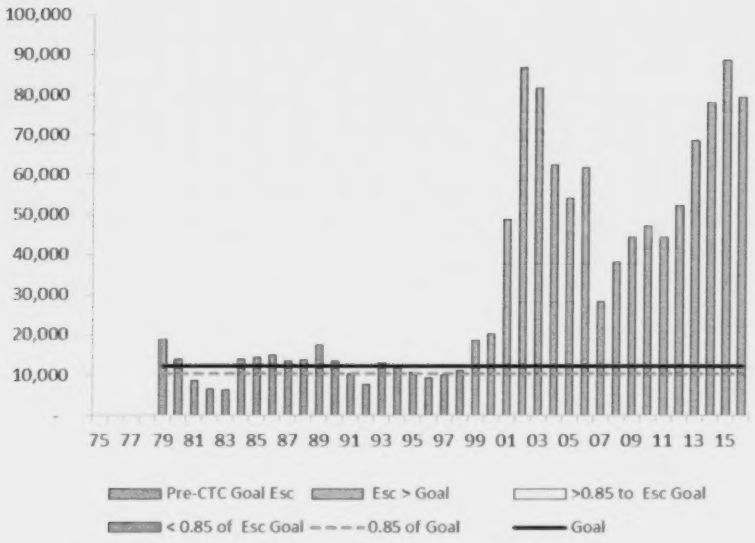


Figure 2.53.–Adult passage of Mid-Columbia Summer Chinook salmon at Rock Island Dam, 1979–2016.

2.3.4.3.3 Coweeman River Tules

The Coweeman River is a third-order tributary to the Cowlitz River located in Cowlitz County, Washington and drains approximately 329 km^2. This watershed supports a small population of mostly natural-origin 3 and 4 year old tule fall Chinook salmon. The Coweeman escapement indicator stock represents ESA listed natural tule fall Chinook salmon production from the Lower Columbia River.

Escapement Methodology: From 2002 to 2011, PSC funding was used to do intensive studies to estimate Chinook escapement (>59 cm) for the entire basin using a variety of methods. These estimates were on average 23% higher than the traditional estimates based on expanding peak fish counts, but study estimates for 2005 and 2007 were nearly double the traditional estimates. MR estimates were done from 2002 to 2004, and in 2011, live-count AUC estimates were done in 2005 and 2006, redd-based escapement estimates were done in 2007 and 2008, and genetic mark–recapture (GMR) was done in 2009 and 2010. Since 2011, a combination of physical MR of fish above the weir and redd count expansion for fish spawning below the weir has been used. A time series of expanded escapement estimates is now available on WDFW's SaSI inventory system. Further details for each year can be found online. The data graphed are total naturally spawning fish (natural and hatchery origin) expanded from redd counts from the mouth of Mulholland Creek (RM 18.4) downstream to the Jeep Club Bridge (RM13.1). Escapement decreased substantially in 2016 (Figure 2.54).

Escapement Goal Basis: The Coweeman stock has no CTC-accepted goal. It is managed according to an abundance-based exploitation rate ceiling schedule for Lower Columbia River Tule Chinook salmon under ESA fishery consultation standards. The agency recovery goal is

3,600 with a maximum recovery exploitation rate determined by NOAA, and an interim minimum natural escapement goal of 1,000.

Agency Comments: Coweeman Tule stock is listed as threatened under the US ESA.

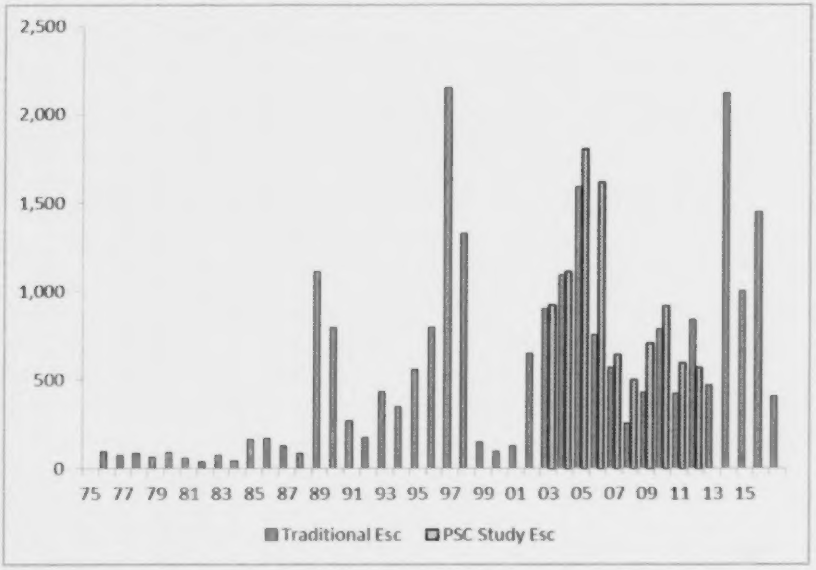


Figure 2.54.–Coweeman River escapements of tule fall Chinook salmon, 1975–2016.

2.3.4.3.4 Lewis River Fall

Escapement Methodology: Most natural bright fall Chinook salmon production below Bonneville Dam occurs in the North Fork Lewis River. The Lewis River Wild stock is the main component of the Lower River Wild management unit for fall Chinook salmon, which also includes small amounts of wild production from the Cowlitz and Sandy river basins. In this report, the escapements and goal are for the Lewis River component. Peak weekly counts of live and dead fish in the 6.4 km area below Merwin Dam (river km 31.4) are expanded by a factor of 5.29 to estimate total spawning escapement (hatchery and wild). This expansion factor was derived from a carcass tagging and recapture study in 1976 (McIsaac 1990 and was verified by studies from 1999 to 2001. Wild smolt have been coded-wire tagged since 1977. Escapement in 2016 decreased substantially but still exceeded the goal (Figure 2.55).

Escapement Goal Basis: The escapement goal of 5,700 fall Chinook in the Lewis River was developed by McIsaac (1990), based on spawner–recruit analysis of the 1964 to 1982 broods and CWT recoveries from the 1977 to 1979 broods. This analysis was updated by the CTC (1999) using brood years 1964 to 1991 and 5,700 was accepted as a biologically based goal.

Agency Comments: Lewis River escapements have been above their escapement goal since 1979, with the exception of 1999, and 2007–2009.

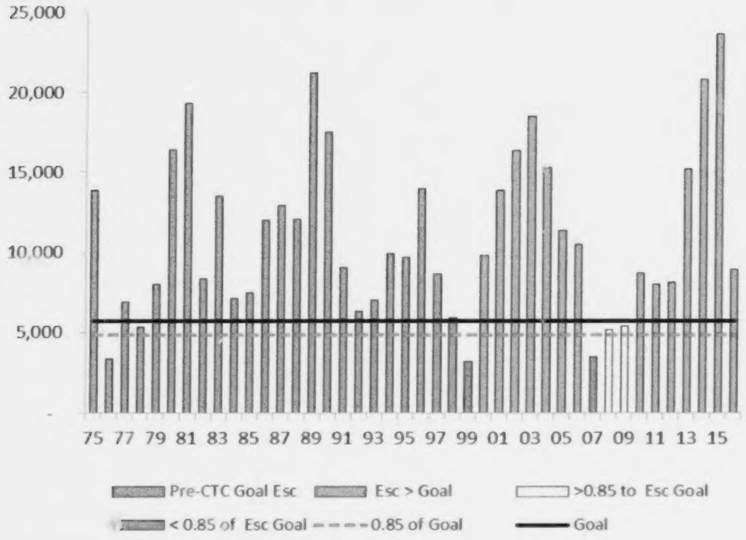


Figure 2.55.–Lewis River escapements of fall Chinook salmon, 1975–2016.

2.3.4.3.5 Deschutes River

Escapement Methodology: Escapement estimates are based on MR estimates above Sherars Falls expanded for redd counts below Sherars Falls. From 2000 to 2007, Confederated Tribes of the Warm Springs Reservation of Oregon did MR studies for the entire river to validate the expansion methodology For historic years when redd counts were done in index areas rather than censused, the time series was adjusted (Sharma et al., unpub.)The estimated escapement in 2016 decreased to 11,628, which is still more than twice the escapement goal (Figure 2.56).

Escapement Goal Basis: A CTC-accepted escapement goal of 4,532 adult fish was derived from the adjusted historical time series (Sharma et al., unpub.).

Agency Comments: Deschutes River fall Chinook salmon escapements have been maintained above goal since 1992. Figure 2.57 compares the whole river MR estimates with the expanded index redd count estimates.

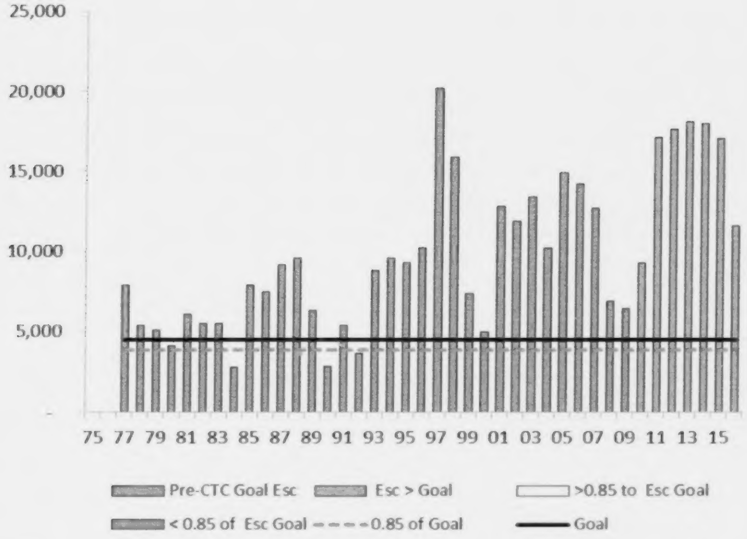


Figure 2.56.–Deschutes River escapements of fall Chinook salmon, 1977–2016.

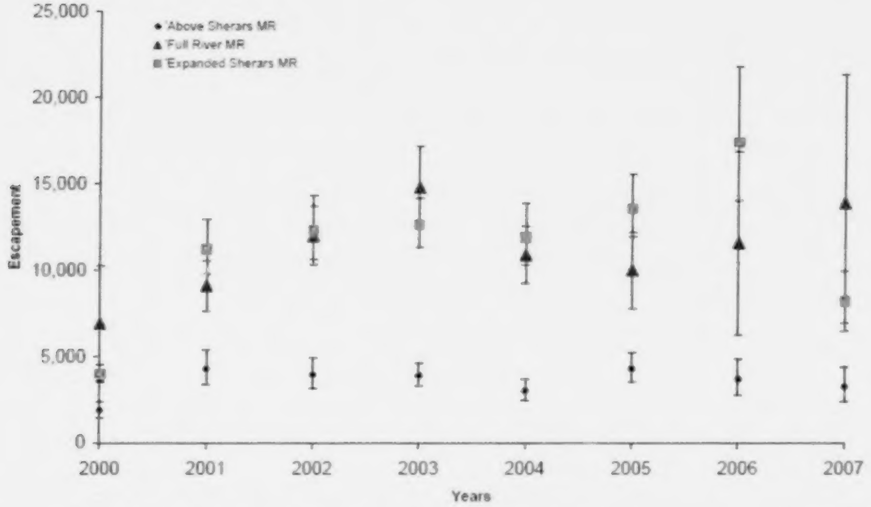


Figure 2.57.–The results of adjusting traditional MR estimates above Sherars Falls using the expansion factor developed from doing MR for the entire river (with 90% CIs).

2.3.4.3.6 Columbia Upriver Brights

Escapement Methodology: Escapement estimates are calculated as the McNary Dam count minus Hanford Reach adult sport, Wanapum tribal catches, and broodstock taken by Priest Rapids, Ringold and Snake River hatcheries. The 2016 escapement estimate of 189,356 is less than half that in 2015 but still well above the escapement goal (Figure 2.58).

Escapement Goal Basis: The CTC-accepted escapement goal for Columbia Upriver Bright Chinook salmon is 40,000 naturally spawning fish past McNary Dam based on stock–recruitment analyses.

Agency Comments: Under the 2008–2017 *US v. Oregon Management Agreement*, the minimum combined Columbia River and Snake River Upriver Bright management goal at McNary Dam is 60,000 adult fall Chinook salmon, which includes both hatchery and natural production for all areas above McNary Dam. The Parties also agreed to a minimum goal of 43,500 Upriver Bright escapement to provide spawning in the Hanford Reach, Lower Yakima River, and mainstem Columbia River above Priest Rapids Dam, as well as Priest Rapids Hatchery production. Fall Chinook salmon fisheries are managed according to a harvest rate schedule ranging from 21.5% to 45%, depending on either (1) the expected river mouth run size of the aggregate fall Chinook salmon run, or (2) the Snake River natural-origin Chinook salmon run—if that run size is associated with a lower harvest rate. Constraints on Columbia Upriver Bright production include the 15% harvest rate limit on commingled ESA listed B-run summer steelhead (>78 cm) for forecast runs of less than 20,000, ESA listed Snake River wild fall Chinook salmon impacts, and of the need for 7,000 broodstock at Spring Creek Hatchery for tule fall Chinook salmon production.

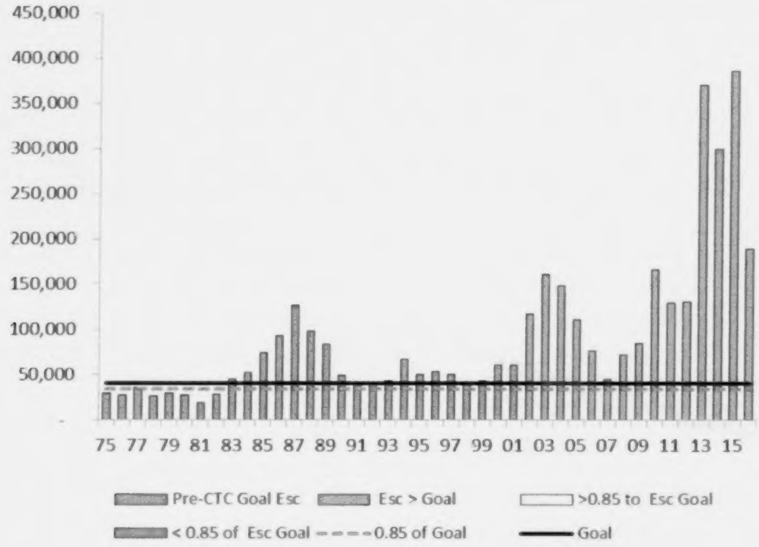


Figure 2.58.–Escapement of Columbia Upriver Bright Chinook salmon, 1975–2016.

2.3.4.4 Coastal Oregon

2.3.4.4.1 Oregon Coastal North Migrating

North migrating Chinook salmon originate from rivers in both the NOC and the MOC aggregates. Chinook salmon production in the NOC occurs mostly from naturally spawned, fall-returning, ocean-type life histories of fish. Adult spawning escapement is dominated by 4- and 5-year-old fish with smaller proportions of 3- and 6-year-old fish. These Chinook salmon from the NOC aggregate stock are caught primarily in SEAK, NBC and in terminal fisheries.

Currently, only NOC fall Chinook salmon are accounted for in PSC management, while work is underway to include MOC stocks into the PST Chinook model. Stocks in the NOC aggregate are those salmon spawning from the Necanicum River in the north through the Siuslaw Basin in the south. Three escapement indicator stocks represent the production of NOC Chinook salmon: the Nehalem, Siletz, and Siuslaw stocks. Other stocks in the NOC aggregate include the Nestucca, Yaquina, Alsea, and Tillamook stocks. The Tillamook stock includes several substocks from the Kilchis, Miami, Trask, Tillamook and Wilson rivers.

Forecasts for the NOC aggregate are based on forecast models developed for each discrete stock, both indicator and non-indicator stocks. The aggregated forecast for the NOC is the sum of the forecasts for the individual basins within the geographic range. Forecasting methods were developed in 2008 and are continually refined with each year's additional information. Prior to 2008, the aggregate forecast (and each of the indicator stock's forecasts) was based on a running 3-year average.

2.3.4.4.1.1 Nehalem River

Escapement Methodology: Both historically conducted surveys which are expanded to represent available habitat (the normative agency methods) and MR based calibrations which utilize that same survey information were used to estimate escapement in the Nehalem during the 2016 return year. Standard estimates were generated from peak abundance observed during surveys of historically walked, standard index areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak count, and the bias observed between these predefined surveys and other survey areas that were randomly selected. Figure 2.59 represents escapement estimates generated using normative agency methodologies, which are directly comparable to the established escapement goal. Comparison between those standard estimates and MR estimates of adult spawning escapement funded by the PSC indicates that in most years (6 out of 9) standard agency escapement estimates fall within the CIs around the comparable MR point estimates for the Nehalem stock (Figure 2.60).

Escapement Goal Basis: The current point goal of 6,989 spawners was derived by Zhou and Williams (1999) and was based on assessments of escapement made through standard survey methodology.

Agency Comments: Methods of escapement estimation comparable to those used to generate the agreed-to escapement goal for the Nehalem indicate a 2016 escapement of 10,074adult spawners. This is 144% of the current escapement goal. After a period of decline between 2006 and 2010, the Nehalem stock has reestablished its traditionally observed high productivity and has met its escapement goal since 2011. Based on multiple forecasting models, the Nehalem stock is forecasted to meet the escapement goal in 2017. ODFW is engaged in analysis to best use results from recent MR experiments to reconstruct historic estimates from peak counts observed in standard surveys and to apply those estimates towards the derivation of an updated escapement goal based on those escapement estimates.

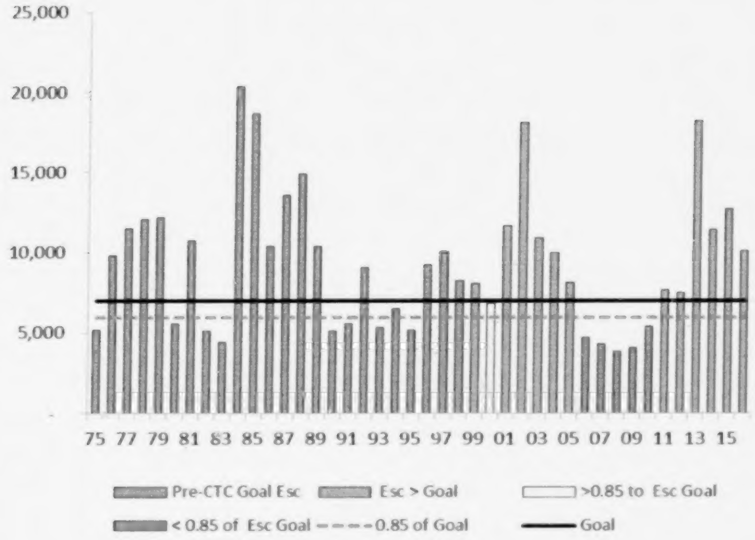


Figure 2.59.–Nehalem River escapements of Chinook salmon, 1975–2016.

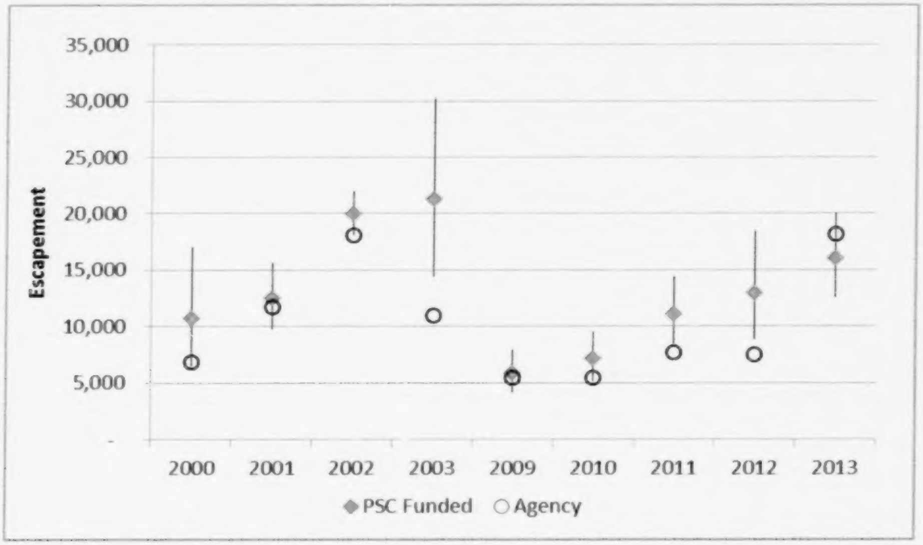


Figure 2.60.–Nehalem River escapements of Chinook salmon in years when both agency historical expanded surveys were used (circles) and when mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Letter of Agreement or SSP funding from the PST.

2.3.4.4.1.2 Siletz River Fall

Escapement Methodology: Standard estimates were generated from peak abundance observed in historically walked, predefined areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak, and the bias seen between these predefined surveys and other survey areas that are randomly selected. Escapement estimates generated using standard agency methodologies were used to develop the current escapement goal, and are presented for comparison with that goal (Figure 2.61).

Escapement Goal Basis: The current point goal of 2,944 spawners is from Zhou and Williams (2000) and was based on assessments of escapement made through standard survey methodology.

Comparison between standard estimates and estimates from MR studies funded by the PSC reveals that for those MR-based estimates with CVs less than 30%, two standard estimates are within the CI around the MR-based estimate; in 2008 the different estimates were nearly identical (Figure 2.62), and again in 2009, both estimates were quite similar.

Agency Comments: This stock has been studied with funds from the SSP to improve escapement estimation using MR methods. However, traditional methods of escapement estimation remain in place until MR experiment-based estimation and a goal based on MR calibrated surveys is complete. The estimate derived from standard methods was 8,479 fall Chinook salmon (288% of goal) in 2016. Following a period of failing to meet escapement goals between 2007 through 2009, this stock has met its escapement goal each year since 2010. This stock is forecasted to exceed its escapement goal in 2017.

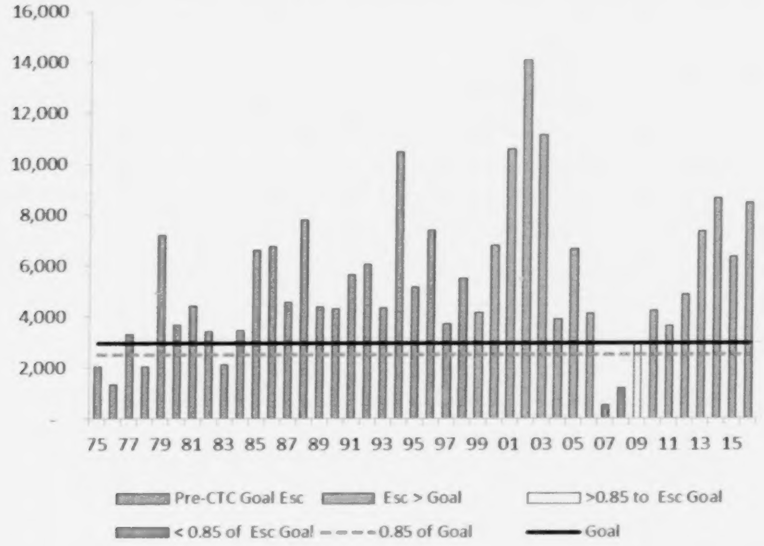


Figure 2.61.–Siletz River fall escapements of Chinook salmon, 1975–2016.

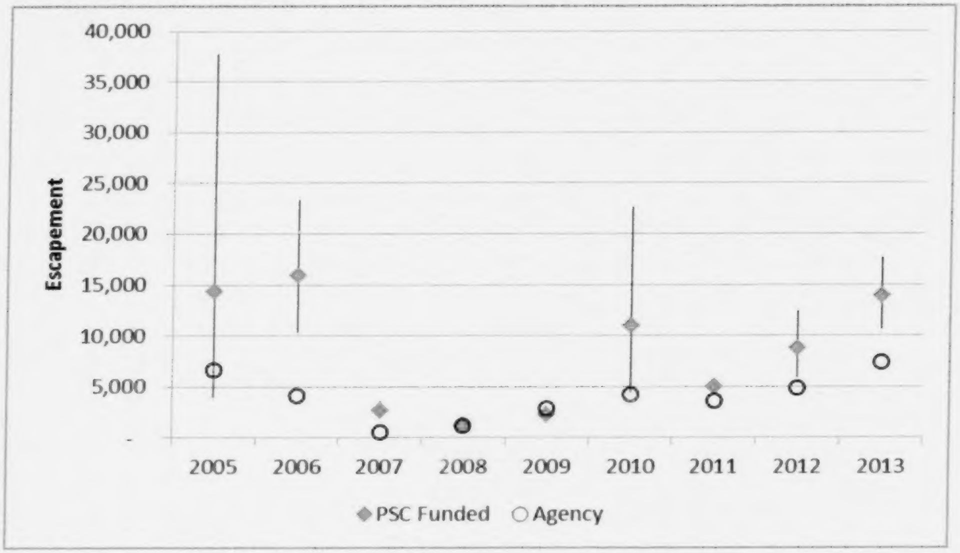


Figure 2.62.–Siletz River escapements of Chinook salmon in years when both agency historical expanded surveys were used (circles) and when mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Letter of Agreement or SSP funding from the PST.

2.3.4.4.1.3 Siuslaw River Fall

Escapement Methodology: Historically conducted standard surveys and updated estimates based on MR calibration factors were utilized to measure escapement in the Siuslaw basin during 2016. Standard estimates were generated from observation of peak abundance in historically walked, predefined areas of known spawning habitat within the basin. These observations were then adjusted by estimates of the total available habitat, estimated observer bias, the total run encountered during the peak, and the bias observed between these predefined surveys and those that are randomly selected. These standard estimates were used to derive the current escapement goal, and are used for comparison with that goal (Figure 2.63). Comparison of the standard agency escapement estimates with PSC-funded MR estimates reveals a clear pattern with the standard estimates being consistently higher that the MR estimates (Figure 2.64). This bias in the agency based estimate will need to be addressed in upcoming revisions of the escapement goal for the Siuslaw River.

Escapement Goal Basis: The current point goal of 12,925 spawners was derived in 2000 by Zhou and Williams (2000) and was based on assessments of escapement made through standard survey methodology.

Agency Comments: Escapement in 2016 for the Siuslaw stock, estimated based on standard habitat expansion methods, was 30,135 adult spawners (233% of the escapement goal). M/R based calibration factor based estimates for this return year produced an estimate of 8,586 adult spawners. The current escapement goal estimate was based on the standard escapement estimates, as used in other basins on the Oregon coast. Ultimately, a new goal should be developed from a calibrated historical data series. This stock is forecast to exceed the current escapement goal in 2017.

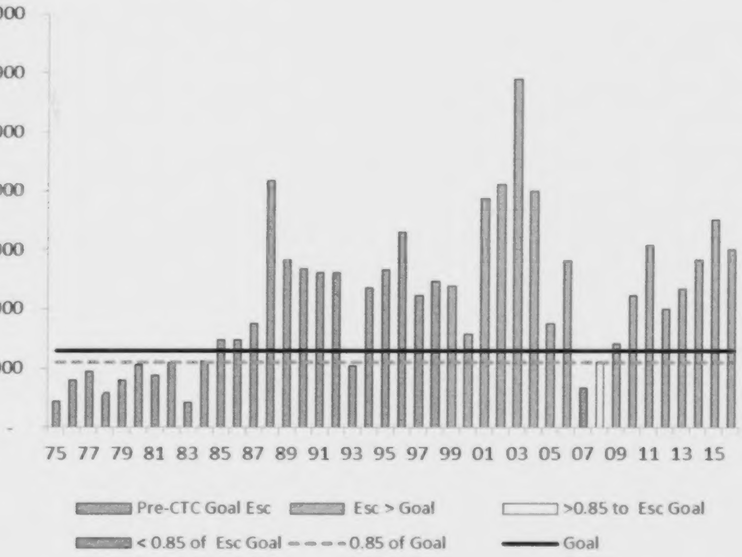


Figure 2.63.–Siuslaw River fall escapements of Chinook salmon, 1975–2016.

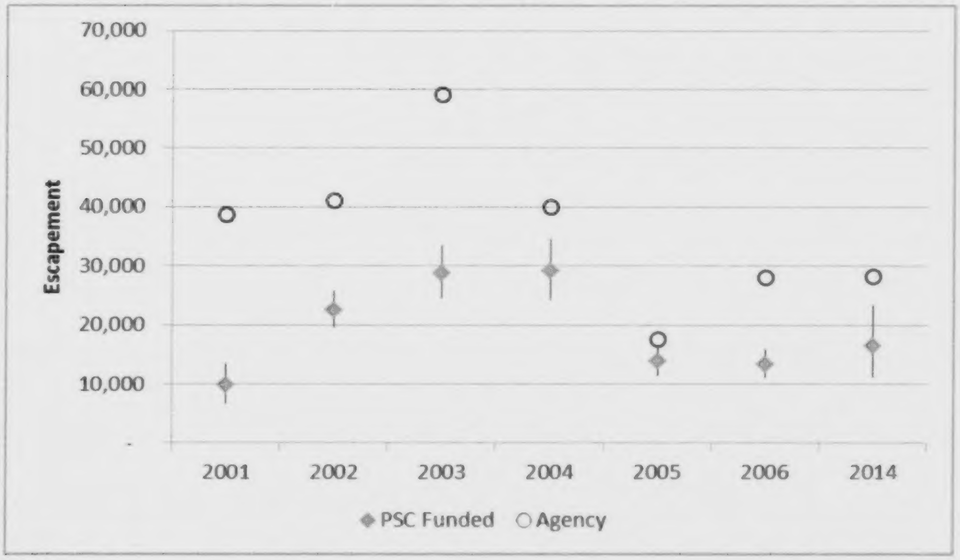


Figure 2.64.–Siuslaw River escapements of Chinook salmon in years when both agency historical expanded surveys were used (circles) and when mark–recapture estimates (diamonds are point estimates and the bars are 95% CIs) were conducted with Letter of Agreement funding from the PST.

2.3.4.4.2 Mid-Oregon Coast

Populations of the MOC have been proposed for inclusion in PSC management, and there are two proposed escapement indicator stocks, the South Umpqua and the Coquille stocks. This area is bounded by the Umpqua River on the north and the Elk River Basin on the south, and includes two additional major basins, the Coos and Coquille, and two small basins, Floras Creek and the Sixes River.

There is a mixture of natural and hatchery-produced salmon originating from the MOC, both of which return in the fall and follow an ocean-type life history. The largest age classes which normally contribute to spawning escapement are 4- and 5-year-old fish; however, there are smaller proportions of spawning escapement that are observed each return year that are 3- and 6-year-old fish. These Chinook salmon are caught primarily in SEAK, NBC, PFMC fisheries and in terminal fisheries.

Forecasts for MOC stocks, except for the Elk River stock, are based on sibling regression relationships developed for each discrete population in 2008 and updated with each year's additional information. Forecasts for the Elk River stock are based on projected survival rates of hatchery releases and recent proportions of wild adults in the aggregate return.

2.3.4.4.2.1 South Umpqua River Fall

Escapement Methodology: Aerial spawning surveys for fall Chinook salmon had been conducted by the ODFW on both the South Umpqua River and Cow Creek since 1978. Aerial spawning fish surveys were started as part of Douglas County's mitigation plan for the construction and operation of Galesville Dam on upper Cow Creek.

Following a 2013 crash that injured two ODFW employees and the pilot; ODFW aerial surveys were discontinued resulting in a change in methodology.

A visual index of abundance has since been developed as an alternative to aerial redd counts. A sum of dead index has been identified from two spawning ground surveys within the South Umpqua drainage as an alternative method to estimate abundance. Results from a calibration assessment of dead Chinook salmon to MR estimates indicated a strong correlation from two reaches in the basin. This calibration to the MR estimates allows for both the long-term redd count data and more contemporary sum of dead counts to be related to known fish abundance.

Figure 2.65 shows South Umpqua River escapement of fall Chinook salmon, 1978–2015.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Recoveries of CWTs from fall run Chinook salmon from the Umpqua River indicate that they are caught in PST fisheries. The 2015 estimate was outside the previous bounds of the previously observed values and resulted in questions of the reliability of the current method. Budget constraints precluded the field work required for 2016 estimates. Funding for the sampling required to provide for an estimate in 2017 has been secured, and the expectation is that the agency will be successful in providing an escapement estimate for this return year.

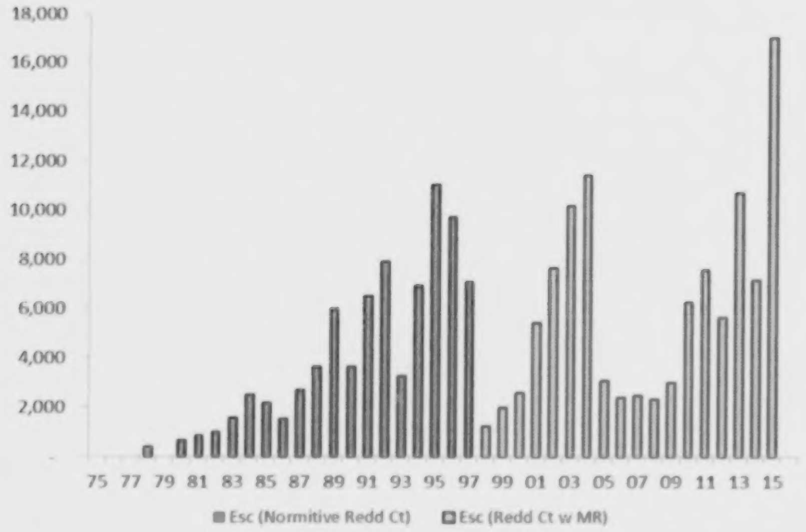


Figure 2.65.–South Umpqua River escapement of fall Chinook salmon, 1978–2015.

2.3.4.4.2.2 Coquille River Fall

Escapement Methodology: Both MR study based calibration factors (Figure 2.66) and historically conducted surveys were used to measure escapement during the past return year. Standard survey methods are identical to those described in the Siuslaw, Siletz and Nehalem basins. Values presented in Figure 2.66 are based on standard habitat survey estimations along with values calibrated to MR estimates. Both standard and MR calibrated estimates may be found in the appendix tables.

Escapement Goal Basis: are based on standard habitat survey estimations along with values calibrated to MR estimates. Both standard and MR calibrated estimates may be found in the appendix tables.

Escapement Goal Basis: ODFW is currently engaged in analysis which will produce an escapement goal for this stock.

Agency Comments: Methods based on MR-calibrated analysis yield an adult Chinook salmon escapement estimate of 9,720 for Coquille Basin spawners in 2016. The traditional habitat expansion-based estimate is 5,048 fish. Both estimates are roughly half of that escapement which was observed in 2015.

Improvements in applying those calibrated values towards the estimation of this and other Oregon Coastal stocks are currently being reviewed and discussed within the agency. It is anticipated that historical time series for each of the basins which have MR calibration studies (Nehalem, Nestucca, Siletz, Siuslaw, South Umpqua, Coos and Coquille rivers) will be updated in a subsequent reporting cycle.

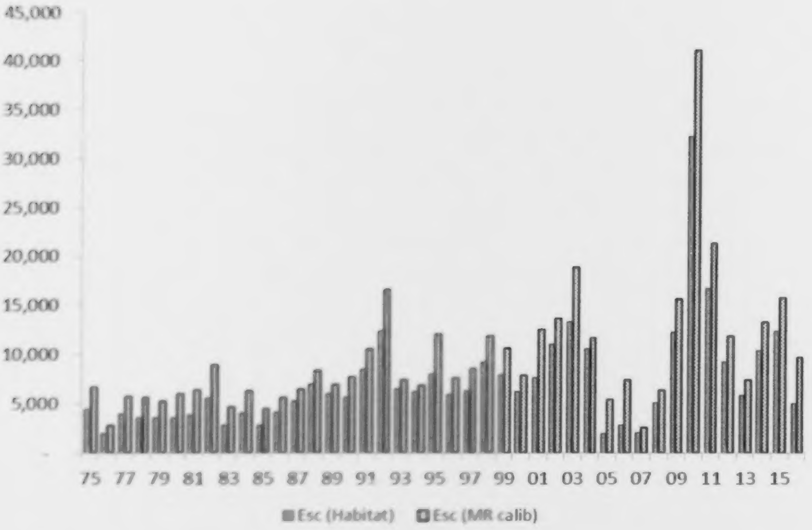


Figure 2.66.–Coquille River escapement of fall Chinook salmon, 1975–2016.

3. STOCK STATUS

3.1 SYNOPTIC EVALUATION OF STOCK STATUS

The following sections include graphics to display stock status information with spawning escapement on one axis and exploitation rate on the other. These synoptic plots display summary information for individual escapement indicator stocks. The figures present both the current status of stocks and the history of the stocks relative to PST management objectives. Information used in these figures includes (1) escapement data; (2) CTC-accepted MSY management objectives (or, in some cases, habitat model or agency stock–recruitment-based escapement objectives that have yet to be submitted to the CTC or agreed upon by the CTC); and (3) exploitation rates from related CWT indicator stocks to clearly summarize the performance of the stocks and fisheries management relative to established or potential goals.

The plots resemble those presented for groundfish in Garcia and De Leiva Moreno (2005). A general depiction of the plots with three reference lines is provided in Figure 3.1. The plots show the annual observations of a stock with regard to fishing rate (x-axis) and escapement abundance (y-axis) from one year to the next. There are three reference lines, one for fishing mortality (U_{MSY}) and two for escapement abundance (S_{MSY}, $0.85*S_{MSY}$) that define five zones on the plots. The definition of reference points for PST Chinook salmon stocks is based on the management objectives (escapement and exploitation rate) identified in the 2009 Agreement. The lower reference line for escapement on the synoptic plots is set at $0.85*S_{MSY}$ due to language in Paragraph 13 of the 2009 Agreement. For stocks with escapement objectives defined as ranges (SEAK, TBR, and the Harrison River), the lower reference line has been defined as 85% of the lower bound of the escapement range and the upper reference line has been set as the lower bound of the escapement range. The exploitation rate reference line (U_{SMSY}) is the exploitation rate at S_{MSY} for stocks with escapement objectives.

The three reference lines produce five zones in the synoptic plots. The green area (Safe Zone) in Figure 3.1 represents a healthy stock status where fishing is below U_{MSY} and the concurrent stock spawning abundance is above the specified escapement goal. The area of high risk (High Risk) is shaded red, and represents an area where a higher-than-prescribed fishing mortality is occurring concurrent with low escapement abundance. The two yellow zones (High Escapement High Exploitation, Low Escapement Low Exploitation) represent situations in which the stock could be in danger of falling into an area of conservation concern; in the upper right (High Escapement High Exploitation), escapement is at a healthy level, but fishing mortality is above the U_{MSY} limit, and in the lower left (Low Escapement Low Exploitation), fishing is occurring below the U_{MSY} limit but the population failed to attain a desired minimum escapement. The cross-hatched region is the PSC buffer zone, indicating problems may arise in the future.

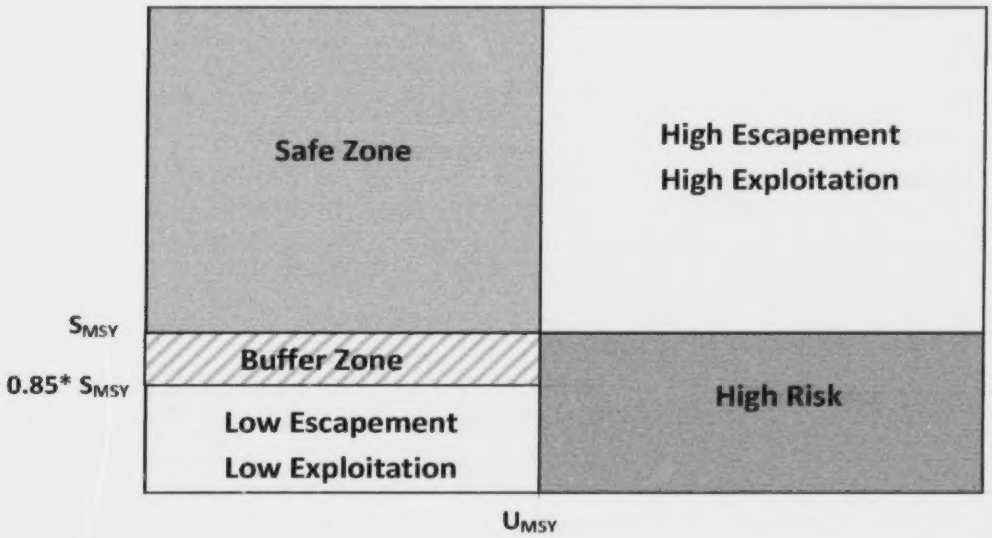


Figure 3.1 -Precautionary plot for synoptic evaluations of PST Chinook salmon stocks.

Exploitation rates used in the synoptic plots are one of the following: CY exploitation rates, preterminal cumulative mature-run equivalent (MRE) exploitation rates, or total (preterminal and terminal) cumulative MRE exploitation rates. Total cumulative MRE exploitation rates cannot be used when there is a terminal fishery that is directed on the hatchery indicator stock because the terminal exploitation will differ from that on the wild stock being represented. The ages used in the escapement and exploitation rate calculations are not the same for each stock presented in the synoptic charts below, and typically exclude age 2 for ocean-type stocks and age 3 for stream-type stocks. See Table 3.1 for parameter definitions..

Calendar year exploitation rates are computed as

$$CYER_{CY} = \frac{OceanMorts_{CY} + TermMorts_{CY}}{(OceanMorts_{CY} + TermMorts_{CY} + OESC_{CY})}$$

Cumulative MRE exploitation rates are computed as

$$CMREER_{CY} = 1 - \left(\frac{OESC_{CY}}{PESC_{CY}}\right)$$

where

$$OESC_{CY} = \sum_{a=startage}^{maxage} OESC_{CY,a},$$

$$PESC_{CY} = \sum_{a=startage}^{maxage} PESC_{CY,a},$$

and

$$PESC_{CY,a} = \frac{OESC_{CY,a}}{CumSurvRte_{CY-a,a}}.$$

When computing total (preterminal and terminal) MRE exploitation rates, the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = TermSurvRte_{BY,a} * \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}.$$

When computing preterminal MRE exploitation rates the cumulative survival rate is computed for each age in a brood year as

$$CumSurvRte_{BY,a} = \prod_{i=startage}^{a} PreTermSurvRte_{BY,i}.$$

The preterminal harvest rates for each age in a brood year are computed as

$$PreTermHR_{BY,a} = \frac{OceanMorts_{BY,a}}{CohortSizeANM_{BY,a}}.$$

The preterminal survival rates for each age in a brood year are computed as

$$PreTermSurvRte_{BY,a} = 1 - PreTermHR_{BY,a}.$$

Table 3.1.–Parameter definitions for all equations used to estimate CY exploitation rates and cumulative mature-run exploitation rates.

Parameter	**Description**
$a =$	age
$BY =$	Brood year
$CY =$	Calendar year
$CMREER_{CY} =$	Cumulative MRE exploitation rate for calendar year *CY*
$CohortSizeANM_{BY,a} =$	Cohort size after natural mortality for brood year *BY* and age *a*
$CumSurvRte_{BY,a} =$	Cumulative survival rate for brood year *BY* and age *a*
$CYER_{CY} =$	Calendar year exploitation rate for calendar year *CY*
$OceanMorts_{BY,a} =$	Ocean mortalities for brood year *BY* and age *a*
$OESC_{CY} =$	Observed escapement for calendar year *CY*
$OESC_{CY,a} =$	Observed escapement for calendar year *CY* and age *a*
$PESC_{CY} =$	Potential escapement for calendar year *CY*
$PESC_{CY,a} =$	Potential escapement for calendar year *CY* and age *a*
$PreTermHR_{BY,a}=$	Pre-terminal harvest rate for brood year *BY* and age *a*
$PreTermSurvRte_{BY,a} =$	Pre-terminal survival rate for brood year *BY* and age *a*
$TermMorts_{CY} =$	Terminal mortalities for calendar year *CY*
$TermSurvRte_{BY,a} =$	Terminal survival rate for brood year *BY* and age *a*

Data necessary to plot the stock trajectories are available for most escapement indicator stocks (Table 3.2). Most escapement indicator stocks have companion exploitation rate indicator stocks that are assumed capable of reflecting the exploitation rates in pre-terminal areas. With suitable assumptions about terminal area fisheries, the total exploitation rates on stocks can be estimated. Most areas along the coast have escapement indicator stocks. Notable exceptions are the UGS area, the WCVI area and the Fraser River early stocks (spring and summer). For UGS, the CTC in the past has reported escapement for an aggregate. In future catch and escapement reports, the CTC will provide the individual metrics in addition to the aggregate numbers. The Fraser early stock consists of additional complexities for escapement indicator stocks, which are delineated on the basis of life history, and the stocks listed in Attachments I, II, and IV, which are based on geography. Region-specific synoptic evaluations of Chinook salmon stocks are presented in Section 3.2.

Table 3.2.–Summary of information available for synoptic stock evaluations.

Region[1]	Escapement Indicator	S_{MSY}	85% of S_{MSY}[2]	Exploitation Rate Indicator	U_{MSY}	Type of Exp. Rate[3]
SEAK	Situk	600	425	Situk wild	0.81	CY
SEAK	Chilkat	2,200	1,488	Chilkat wild	0.40	CY
SEAK	Unuk	2,764	1,530	Unuk wild	0.60	CY
SEAK	Chickamin	2,494	1,828	Alaska Hatchery (Neets, Whitman, Deer) and Unuk wild	0.72	CMRE
TBR	Alsek	4,677	2,975	Alsek wild	0.58	CY
TBR	Taku	25,500	16,150	Taku wild	0.59	CY
TBR	Stikine	17,400	11,900	Stikine wild	0.42	CY
BC	Harrison	75,072	63,811	Chilliwack	0.57	CMRE
BC	Cowichan	6,514	5,537	Cowichan	0.69	CMRE
BC	Kitsumkalum	8,621	7,328	Kitsumkalum	0.61	CMRE
BC	Atnarko	5,009	4,258	Atnarko	0.77	CMRE
BC	Nicola	8,337	7,086	Nicola	0.59	CMRE
BC	Lower Shuswap	12,339	10,488	Lower Shuswap	0.73	CMRE
COLR	Columbia Upriver Summer	12,143	10,322	Columbia Summers	0.75	CMRE
COLR	Columbia Upriver Brights	40,000	34,000	Upriver Brights	0.56	CMRE
COLR	Deschutes River Fall	4,532	3,852	Lewis River Wild	0.79	CMRE
COLR	Lewis River Fall	5,791	4,922	Lewis River Wild	0.79	CMRE
WAC	Quillayute Fall	3,000	2,550	NA		NA
WAC	Queets Spring/Summer	700	595	NA		NA
WAC	Queets Fall	3,000	2,550	Queets Fall Fingerlings	0.74	CMRE
WAC	Hoh Spring/Summer	900	765	NA		NA
WAC	Hoh Fall	1,200	1,020	NA		NA
ORC	Nehalem	6,989	5,941	Salmon River	0.69	CMRE
ORC	Siletz	2,944	2,502	Salmon River	0.81	CMRE
ORC	Siuslaw	12,925	10,986	Salmon River	0.61	CMRE

[1] See List of Acronyms for definitions.

[2] Stocks with an escapement goal range use 85% of the lower bound.

[3] Two types of exploitation rates were used: cumulative mature-run equivalents (CMRE) and calendar year (CY) which are based off of actual stock assessment data gathered annually for each stock.

A synoptic summary figure for 23 stocks with 2015 data shows that the majority of stocks were in the safe zone (Figure 3.2). No stocks were in the high-risk zone, two stocks (Situk and Nicola) were in the low escapement and low exploitation zone, and one stock was in the buffer zone (Cowichan). One stock (Columbia Summers) experienced exploitation above U_{MSY} and still the escapement exceeded S_{MSY} by more than 7-fold. The Southeast Alaska, Transboundary River, and Washington and Oregon coastal stocks clustered closer to the 1.0 index lines than the other regional groups. In general, Columbia River stocks showed a higher escapement to S_{MSY} index than the other regions where there was no pattern.

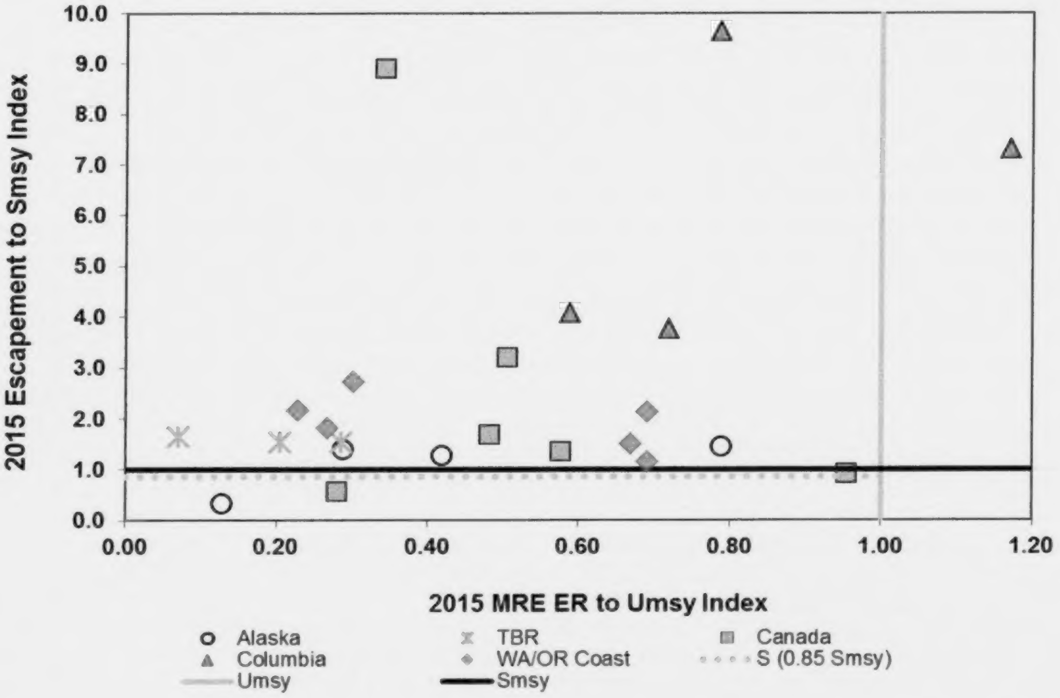


Figure 3.2.–A synoptic summary by region of stock status for stocks with escapement and exploitation rate data in 2015.

Note: Escapement and exploitation rate data were standardized to the stock-specific escapement goal and U_{MSY} reference points.

3.2 REGIONAL TRENDS AND PROFILES

3.2.1 Southeast Alaska: Situk, Chilkat, Unuk, and Chickamin Rivers

Recent declines in Chinook salmon productivity and abundance are widespread and persistent throughout Alaska, particularly in western and northern Alaska. Available run abundance data indicate significant declines were first fully detected in 2007 from a persistent decline in productivity that began with returns from brood year 2001. Run abundance data available from 21 stocks in Alaska show substantial variability and moderate to no coherence among stocks prior to 2004 (Figure 3.3). This is consistent with downward trends in productivity and similar declines of SEAK Chinook salmon stocks.

The SEAK stocks have two main rearing behaviors that are consistent and predictable. Outside-rearing behavior includes rearing in the Gulf of Alaska and Bering Sea after leaving the freshwater environment. Inside-rearing behavior involves rearing in the nearshore environment of SEAK. Outside-rearing stocks include the Situk River stock, and the transboundary Alsek, Taku, and Stikine stocks; the majority of these fish strictly adhere to this behavior. Inside-rearing stocks include the Chilkat, Unuk, and Chickamin stocks, and although the vast majority rear in the nearshore environment, CWT information suggests at least a small proportion of these fish exhibit outside-rearing behavior. Productivity has decreased for both outside- and inside-rearing stocks; the decline is far reaching, extends beyond SEAK, and has affected most Alaska Chinook stocks.

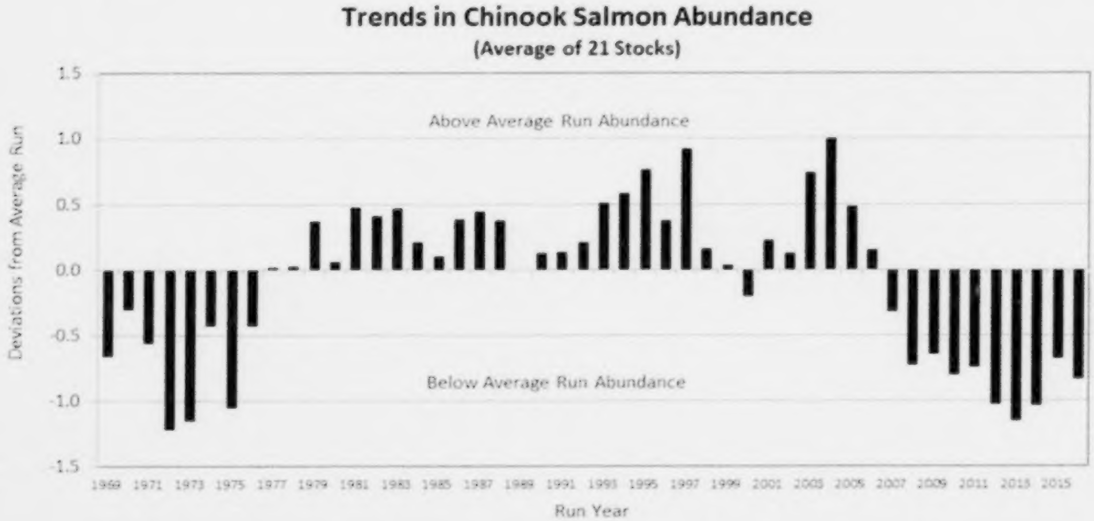


Figure 3.3.–Average of standardized deviations from average run abundance for 21 stocks of Chinook salmon in Alaska (the Unalakleet, Nushagak, Goodnews and Kuskokwim in western Alaska; the Chena and Salcha on the Yukon River; the Canadian Yukon, the Chignik and Nelson on the Alaska Peninsula; the Karluk and Ayakulik on Kodiak Island; the Deshka, Anchor and late run Kenai in Cook Inlet, the Copper in the northeastern Gulf of Alaska, and the Situk, Alsek, Chilkat, Taku, Stikine, and Unuk in Southeastern Alaska).

The Situk River stock has failed to meet the escapement goal six times since 2009. Over the recent decade, this stock has demonstrated the poorest performance among the four SEAK escapement indicator stocks. It is unlikely that this failure can be attributed to fishery impacts alone, because the impacts are among the lowest in the region. Because harvests are mostly inriver or in the estuary, detailed catch accounting programs enumerate the vast majority of the harvest, yielding CY estimates of exploitation. Because this stock is outside rearing, it is not exposed to SEAK harvest before maturation. Calendar year exploitation rates for the Situk River stock have never exceeded the U_{MSY} threshold of 81%. During the recent eight years of poor escapements, for Situk River exploitation rates have averaged 20%, including a low of 3% in 2011 when estimated escapement was 48% of the goal. The 2016 exploitation rate was 6% and escapement was 66% of the lower bound of the escapement goal (Figure 3.4). The poor runs and escapement primarily result from decreased productivity, and mirror the very low productivity of other Alaska stocks that rear in the Gulf of Alaska and Bering Sea. Management measures have been in place to reduce harvests and increase escapement. Even with very restrictive management actions, the escapement goal for the Situk River stock will be difficult to attain until productivity improves.

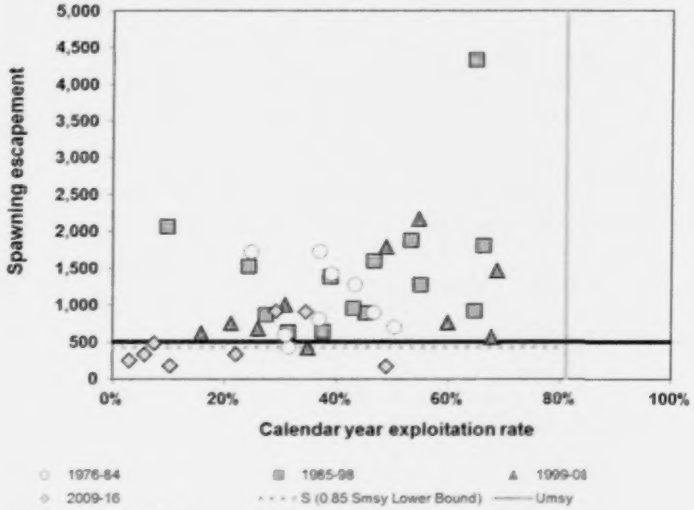


Figure 3.4.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-2 Situk River Chinook salmon, 1976–2016.

Chilkat River Chinook salmon return to northern SEAK and are mostly inside rearing. The Chilkat River stock failed to achieve its escapement goal four times since 2009. The Chilkat River is located at the northern end of Lynn Canal; gillnet and sport fisheries in the region are managed to conserve this stock.

A CWT program is in place to estimate harvest of the Chilkat River Chinook salmon. Recoveries of CWTs indicate some age-4 Chilkat River fish are harvested while rearing in SEAK, primarily in net fisheries. The majority of harvest is of mature fish from sport, commercial troll, and drift gillnet fisheries in SEAK. In general, exploitation rates on the Chilkat River stock are some of the lowest observed for Chinook salmon stocks, with a recent 10-year average exploitation rate of 16%, well below the threshold reference value of 40% (Figure 3.5).

Smolt abundance and survival have been estimated for the Chilkat River stock since the 1999 brood year. There is no apparent trend in freshwater survival; however, marine survival has been below average for the three most recent broods (Figure 3.6). Below average productivity has negatively affected abundance and continued low exploitation rates are needed to achieve the escapement goal until productivity improves.

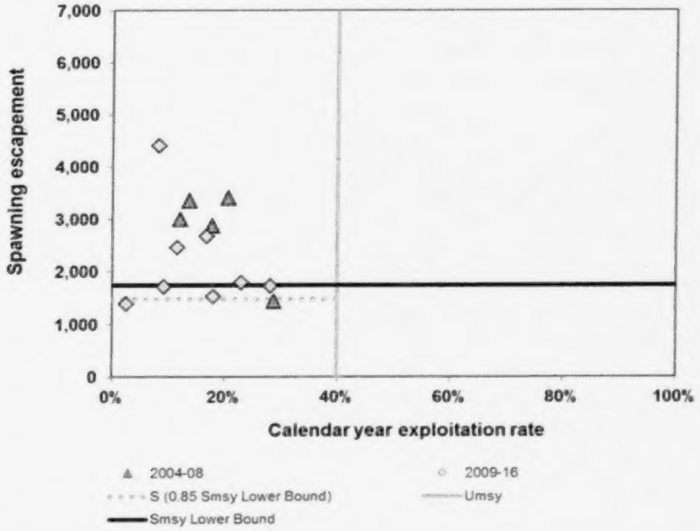


Figure 3.5.–Calendar Year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-3 Chilkat River Chinook salmon, 2004–2016.

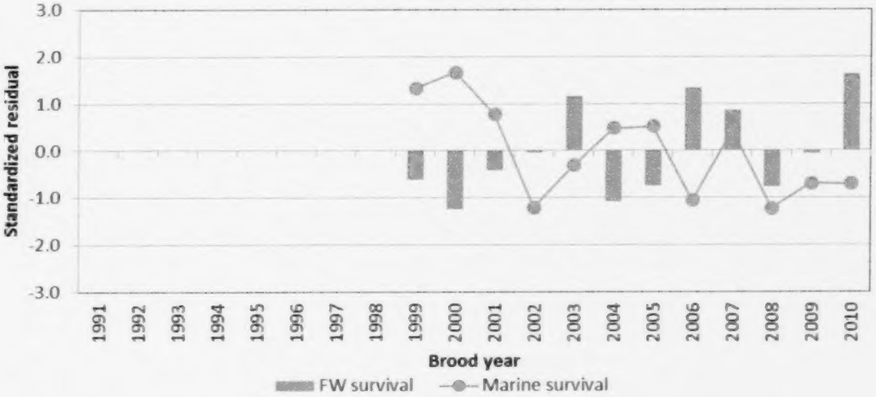


Figure 3.6.–Freshwater and marine survival indices (standardized to a mean of zero) for the Chilkat River stock of Chinook salmon, 1999–2010 brood years.

The Unuk and Chickamin rivers flow into Behm Canal in southern SEAK and Chinook salmon from these rivers are mostly inside-rearing. Escapements to the Unuk River were below the escapement goal from 2012 to 2014, and again in 2016. Escapements to the Chickamin River also failed to reach the escapement goal in 2014 and 2016. For the Unuk River, these were the only occasions when the escapement goal was missed in the past 40 years; for the Chickamin River these were the only two years in over a decade that the goal was not attained. There are no Chinook salmon fisheries in these rivers or in most marine waters of the adjacent Behm Canal. Generally, southern SEAK stocks are harvested at relatively low rates while rearing and maturing, and they are not harvested in terminal areas due to management closures. Although Chinook salmon that return to the Unuk River are similar in size at age to other northern SEAK stocks, size at age for Chickamin River Chinook salmon is considerably larger and thus these fish are recruited into sport and troll fisheries as legal sized fish at younger age when compared to Unuk River Chinook salmon.

A CWT program is in place to estimate harvest for the Unuk River stock. In sharp contrast to other SEAK stocks, the Unuk River exploitation rates have been high in recent years. Some Unuk River Chinook salmon are caught while rearing in SEAK but most harvest is of mature fish. Exploitation rates on this stock have averaged about one-half the threshold reference value but during the recent period of poor production, rates have been the highest on record, including an over the U_{MSY} threshold exploitation rate of 72% in 2012 (Figure 3.7). As a result, additional domestic management measures have been imposed to reduce exploitation rates and pass more fish to escapement.

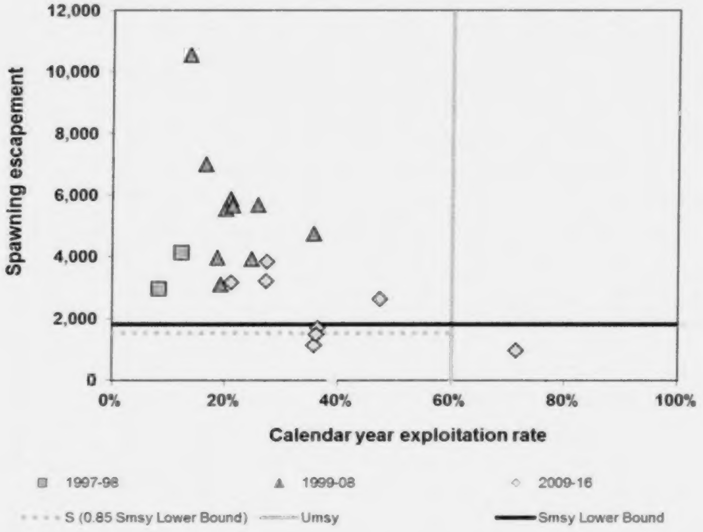


Figure 3.7.–Calendar Year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-3 Unuk River Chinook salmon, 1997–2016.

Smolt abundance and survival have been estimated for the Unuk River stock since the 1992 brood year. Freshwater survival has, for the most part, shown no apparent pattern. The 2003 and 2005 brood year freshwater survival estimates were some of the lowest on record; however, like the Chilkat River stock, the 2006 brood year showed the best freshwater survival observed since the project began. Unfortunately, the high freshwater survival for the 2006 brood year coincided with the lowest marine survival and the highest marine survival for the 2005 brood year coincided with the lowest freshwater survival. Marine survival was near-average and cycled annually over the 1991–2005 brood years. However, the 2006–2009 brood years exhibited some of the lowest marine survivals over the range of data (Figure 3.8).

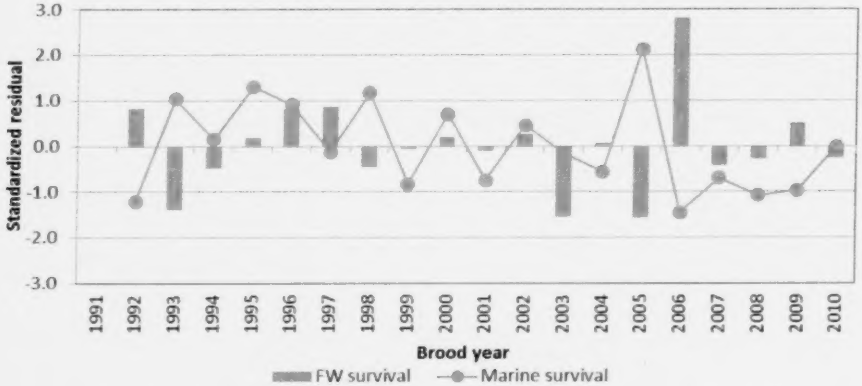


Figure 3.8.–Freshwater and marine survival indices (standardized to a mean of zero) for the Unuk River stock of Chinook salmon, 1992–2010 brood years.

There is no CWT program for the Chickamin River. MRE exploitation rates from the nearby Neets Bay and Whitman Lake hatcheries are used as surrogate values, after discounting terminal hatchery harvests. These hatcheries use the Chickamin River stock as a brood source and fish produced in these hatcheries are available to harvest both as rearing and mature fish in SEAK. Due to the larger size of Chickamin River Chinook salmon, the majority of ocean-age-2 Chickamin fish exceeded the 28-inch legal length for harvest and they recruit to sport and troll fisheries. Despite this early recruitment, the Chickamin River stock has displayed relatively low exploitation rates, has never exceeded the threshold reference line, and has averaged less than one-half the threshold reference value (Figure 3.9).

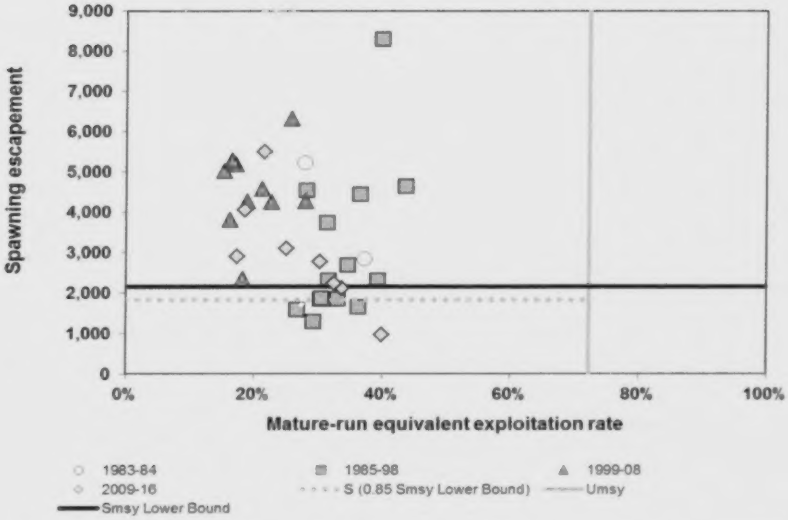


Figure 3.9.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-2 Chickamin River Chinook salmon, 1983–2016.

3.2.2 Transboundary Rivers: Alsek, Taku, and Stikine Rivers

The Alsek River stock has failed to achieve the escapement goal three times since 2009, and of the three TBR stocks, the Alsek River stock has missed the escapement goal most frequently. It is unlikely that this failure can be explained by over-harvest, as the Alsek River stock has one of the lowest exploitation rates among the CTC escapement indicator stocks, averaging 7% between 1976 and 2016. Harvests occur inriver in the U.S. and Canada. Detailed catch accounting and age, sex, length, and genetic sampling programs are in place for U.S. harvests. In Canada, programs are in place to enumerate sport and Aboriginal harvests and age, sex, length, and genetic information are gathered at a weir across the Klukshu River, an index tributary of the Alsek River, along with complete census of the inriver run. Similar to Situk River Chinook salmon, this stock is outside rearing, and is not exposed to SEAK fisheries while rearing. Exploitation rates have never approached the U_{MSY} threshold of 58%, and since 2009 have averaged 8% (Figure 3.10). Poor runs and escapement are primarily the result of decreased productivity and mirror other Alaskan stocks that rear in the Gulf of Alaska and Bering Sea. Management measures have been in place to reduce harvests and increase escapement during this period of poor production.

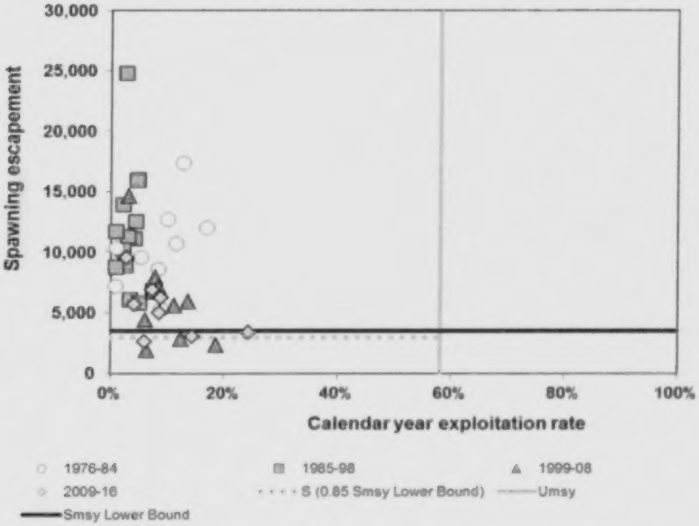


Figure 3.10.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement ≥ocean age-2 Alsek River Chinook salmon, 1976–2016.

The Taku and Stikine river stocks have also experienced reduced productivity recently. Preseason forecasts are developed for each of these stocks by December 1 per obligations specified in Chapter 1 of the PST. The preseason forecasts trigger directed Chinook salmon fisheries in the U.S. and Canada during years of surplus production, and in-season estimates are used to refine fishery management. In recent years, forecasts have overestimated the run size, and to account for this, forecasts have been adjusted by the five-year average percentage error. This method has performed well. Despite reduced productivity, escapement goals have been achieved for both stocks in all but one year since 2009.

In years of surplus production, exploitation rates have been increased accordingly. For the Stikine River stock, this has resulted in the threshold reference value being exceeded three times since directed fisheries were developed in 2005; however, escapement goals were achieved in those three years. These stocks rear in the Gulf of Alaska and Bering Sea and as a result, have reduced exposure to SEAK fisheries as immature fish; the primary harvest on these stocks is on mature adults.

Between 1976 and 2004, terminal commercial fisheries targeting these two stocks were closed or severely restricted. Both stocks are harvested in local marine sport fisheries and incidentally in U.S. and Canadian traditional sockeye salmon gillnet fisheries that take place near the end of the Chinook salmon runs. Both stocks are also caught outside of the terminal districts in commercial spring troll fisheries, and to some extent, in outside sport and net fisheries. Regardless, most harvest takes place in-river and in the terminal districts, and detailed genetic stock identification programs are in place to identify Taku and Stikine Chinook salmon in the mixed stock marine waters. This program, when coupled with the assessment methods described in McPherson et al. (2010) for CYs 1977–2007 for the Taku River stock and in Bernard et al. (2000) for CYs 1981–1997 for the Stikine River stock, has been used to provide CY harvest estimates since 2005. Exploitation rates for the Taku River have never exceeded the U_{MSY} threshold of 59%. Since 2009, calendar-year exploitation rates averaged 23%, and escapements failed to meet the escapement goal in 2013 and 2016. Between 1975 and 2008, the average exploitation rate was 14%, and escapements were below the goal in 5 years (Figure 3.11).

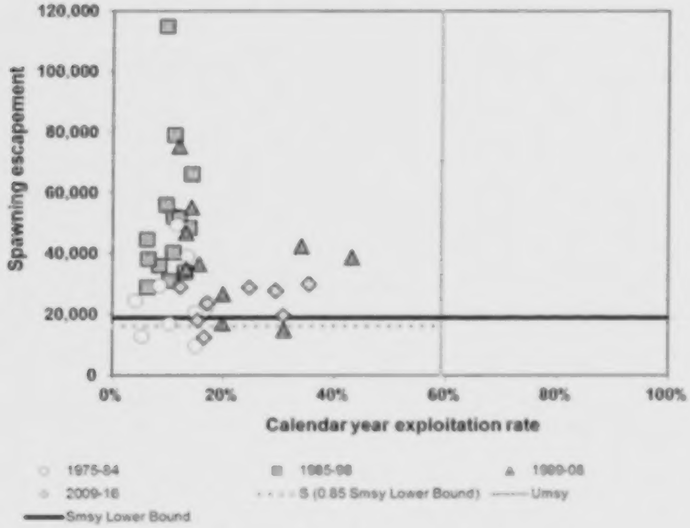


Figure 3.11.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-3 Taku River Chinook salmon, 1975–2016.

Since 2009, Stikine River Chinook calendar-year exploitation rates averaged 21%, and escapements failed to meet the escapement goal in 2009 and 2016. Substantial directed fishing occurred from 2005 to 2008 and exploitation rates averaged 47%, over the U_{msy} threshold value of 42%; however, the escapement goal was achieved annually during this period. Prior to 2005, the average exploitation rate was 20%, and escapements were above the goal in all but 7 years (Figure 3.12).

Exploitation rates on Alsek, Taku, and Stikine river stocks will need to remain low until production improves.

Chinook salmon smolt abundance and survival have been monitored for the Taku River stock since the 1991 brood year. Freshwater survival has been above average in recent years; however, marine survival has undergone cycles throughout this period and the most recent ten brood years have been below average (Figure 3.13).

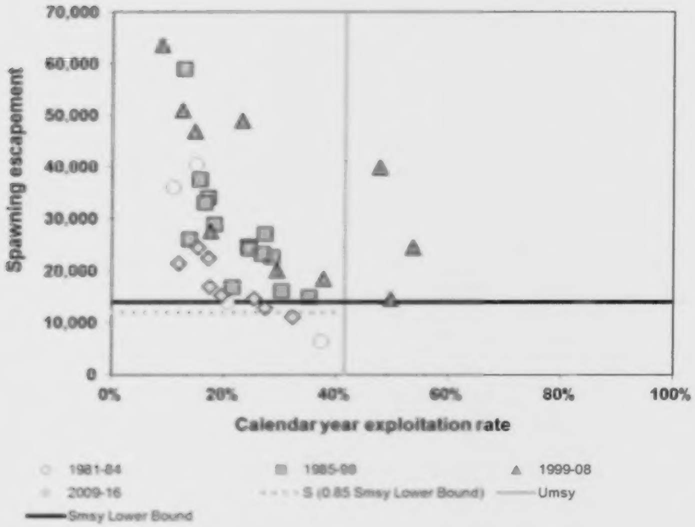


Figure 3.12.–Calendar year exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement for ≥ocean age-3 Stikine River Chinook salmon, 1981–2016.

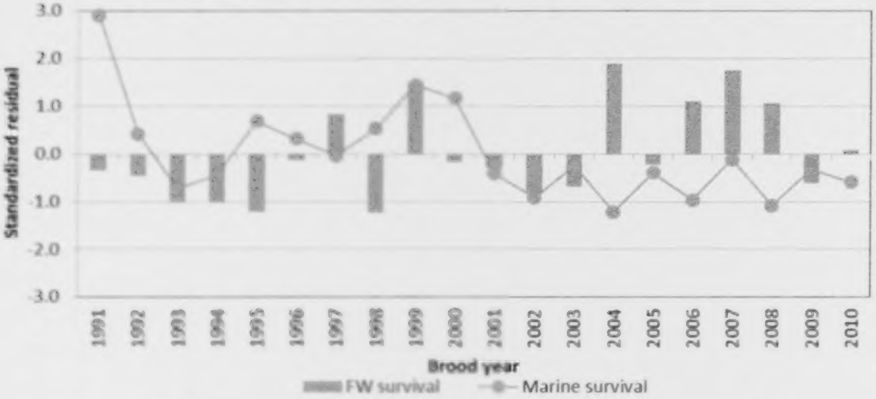


Figure 3.13.–Freshwater and marine survival indices (standardized to a mean of zero) for the Taku River stock of Chinook salmon, 1991–2010 brood years.

Smolt abundance and survival have been monitored for Stikine River Chinook salmon since the 1998 brood year. No trends are apparent in freshwater survival; however similar to Taku River, marine survival has been below average for the most recent brood years (Figure 3.14).

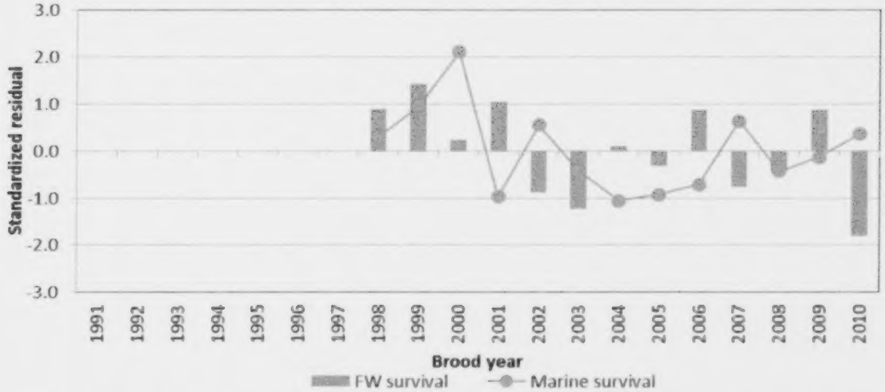


Figure 3.14.–Freshwater and marine survival indices (standardized to a mean of zero) for the Stikine River stock of Chinook salmon, 1998–2010 brood years.

3.2.3 Canadian Stocks

3.2.3.1 Northern British Columbia: Kitsumkalum River

The North/Central BC model stock group includes the Yakoun, Nass, and Skeena escapement indicators in Northern BC. Currently, none of these indicator stocks have CTC-agreed escapement goals. The exploitation rate indicator stock for the North/Central model stock group is the Kitsumkalum in the Lower Skeena River; high quality MR escapement estimates have been produced for this stock annually since 1984. This stock has had a very low level of enhancement relative to the CWT indicator stock targets (mean enhanced contribution = 3.4%, range = 0.4–9.4%, run years 1985–2012). McNicol (1999) reviewed these data and estimated the stock–recruit relationship, which was updated by Parken et al. (2006). Marine survival has been below average since the 2007 brood year (Figure 3.15). The mature-run equivalent exploitation rates have been below the threshold reference line in all years (Figure 3.16). Spawning escapements have exceeded S_{MSY} reference line in all years but three. In the earliest period (1989–1998), there were two years in which the stock was in the buffer zone and one of the years the stock was in the low escapement and low exploitation zone. Recently (1999–2016), the stock has been in the safe zone.

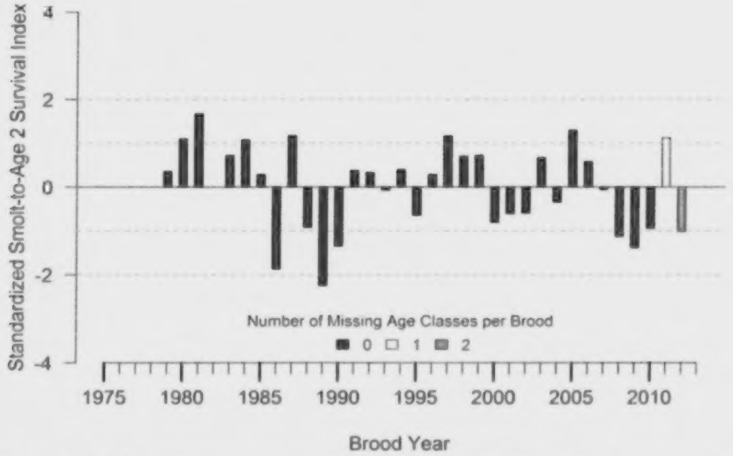


Figure 3.15.–Marine survival index (standardized to a mean of zero) for the Kitsumkalum River stock of Chinook salmon, 1979–2012 brood years.

Note: Brood year 1982 was not represented by CWTs; thus no datum is available.

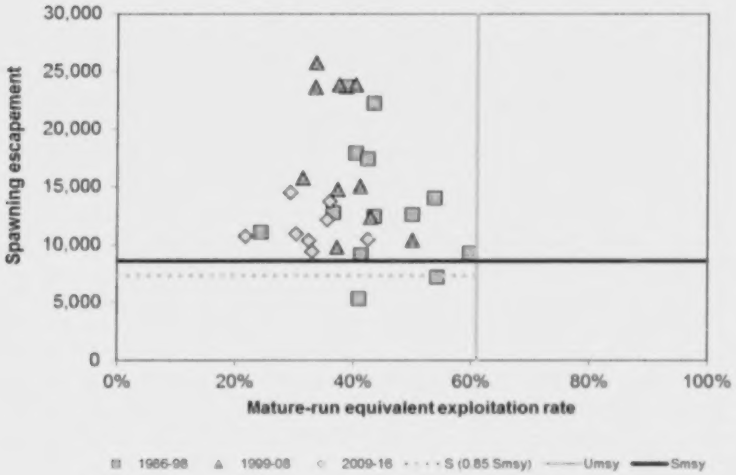


Figure 3.16.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Kitsumkalum River stock of Chinook salmon, 1985–2016.

3.2.3.2 Central British Columbia: Atnarko River

The North/Central BC model stock group includes the Dean and Atnarko escapement indicators in Central BC. Currently, none of these indicator stocks have CTC-agreed escapement goals. The Atnarko River was added as an exploitation rate indicator stock in Area 8 in 2012 (Vélez-Espino et al. 2011) with MR escapement estimates produced annually (Vélez-Espino et al. 2010). These estimates were used to calibrate the time series of existing carcass count based escapement estimates and broodstock CPUE back to 1990 (Vélez-Espino et al. 2014). This stock has had a moderate level of enhancement relative to the CWT indicator stock targets (mean enhanced contribution = 35%, range = 13–67%, run years 1990–2015).

The largest hatchery contributions occurred in the mid-1990s, reaching 67% in 1996, whereas the lowest (13%) took place in 2008. Recent increases in hatchery contribution are partly due to the implementation of yearling releases in addition to the subyearling releases. Adjustments have been made to escapement estimates to remove hatchery fish in order to make inferences for unenhanced stocks in Central British Columbia (Vélez-Espino et al. 2014). A stock–recruitment relationship has not yet been generated; however, a habitat-based estimate of S_{MSY} (Parken et al. 2006) of 5,009 large adults has been developed for Atnarko Chinook salmon (Vélez-Espino et al. 2014).

The average marine survival (i.e., age-2 cohort survival) of Atnarko Chinook salmon is 2.4% (for brood years 1986–2012), with an increasing tendency from brood year 1986 to brood year 1991, and remaining below average for most years from brood year 1992 up to brood year 2009. For brood years 2010–2012, marine survival increased to a level comparable to that achieved for brood year 1990 and reached the highest recorded level (6.1%) for brood year 2011 (Figure 3.17).

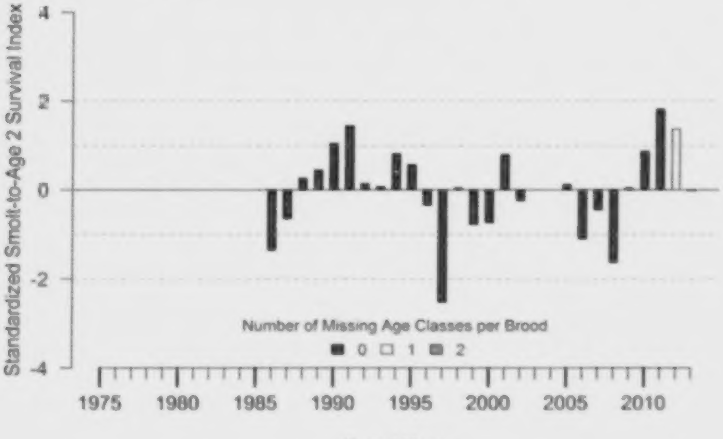


Figure 3.17.–Marine survival index (standardized to a mean of zero) for subyearling releases of the Atnarko River stock of Chinook salmon, 1986–2012 brood years. There were no CWT releases for brood years 2003 and 2004.

Escapement estimates of large adults (total wild and hatchery, excluding jacks) have exceeded S_{MSY} in all years except in 2012 when the escapement estimate was 4,622. The 2012 escapement of large adults was, however, greater than the 0.85 S_{MSY} lower threshold of 4,258, thus falling in the escapement buffer zone (Figure 3.18 and Figure 3.19). Since mature-run equivalent exploitation rates have been below the threshold reference line in all years, this stock has been in the safe zone for all years except in 2012 (Figure 3.19). Wild large Atnarko

Chinook have also exceeded S_{MSY} in all years except in 1997 and 2012, when the escapement estimates were below S_{MSY} at 4,013 and 2,542, respectively (Figure 3.18).

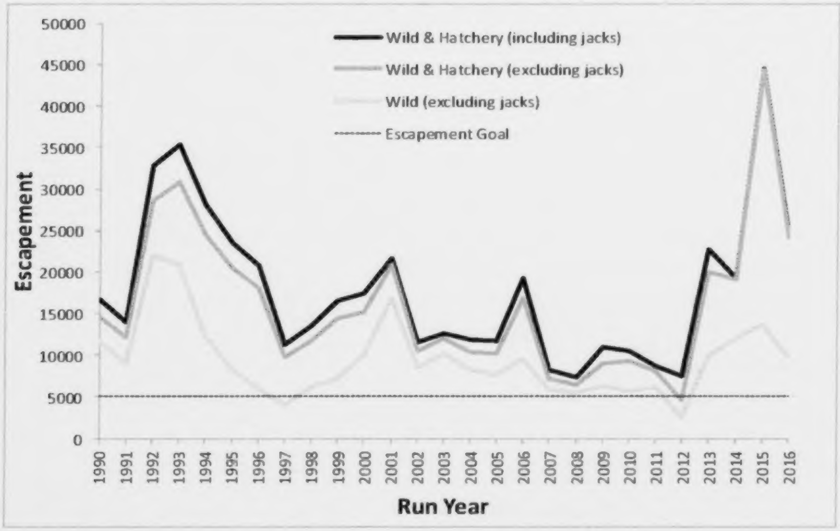


Figure 3.18.–Time series of Atnarko Chinook escapement integrating the calibrated values from best Generalized Linear Model and the best Maximum Likelihood estimates for years with mark–recapture studies (2001–2003 and 2009–2016).

Note: The dashed line shows the habitat-based escapement goal.

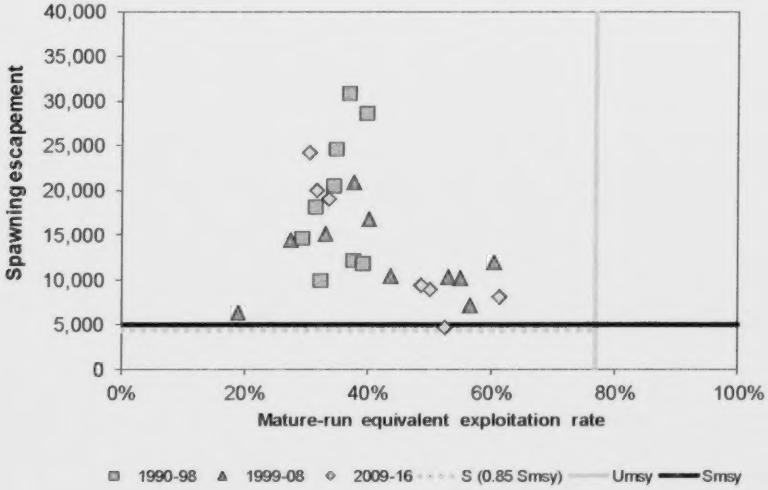


Figure 3.19.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Atnarko River stock of Chinook salmon, 1990–2016.

Note: Spawning escapement excludes jacks to be consistent with the units represented by the S_{MSY}-based escapement goal.

3.2.3.3 Lower Strait of Georgia: Cowichan River

The Lower Strait of Georgia natural stock group includes the Cowichan River and Nanaimo River escapement indicators. Currently, only the Cowichan has a CTC-accepted escapement goal. A habitat-based estimate of S_{MSY} is available for the Nanaimo River; however, the exploitation rate indicator program was discontinued after brood year 2004. The Cowichan River is an exploitation rate indicator stock that has escapement estimates produced by fence (weir) and MR methods. This stock has had a high level of enhancement (mean enhanced contribution = 22%) for run years 1982–2016 (Figure 3.20), which influences the representativeness of this stock for others in Lower Strait of Georgia. The largest contribution occurred in 2002 (62%). Tompkins et al. (2005) reviewed the Cowichan data and estimated the stock–recruit relationship. Marine survival was generally above average for brood years 1985 to 1992, below average from 1993 to 2009, and slightly above average in 2010 and about average in 2011 (Figure 3.21). The cumulative exploitation rates have been above the threshold reference line in about 70% of the years and escapements were below S_{MSY} between 1997 and 2015, and exceeded S_{MSY} in 2016 (Figure 3.22). The stock has rarely been in the safe zone of the synoptic plot, only once during the last 26 years, with most of the recent years in the high risk zone. The stock experiences the highest exploitation of the stocks examined in Section 3.

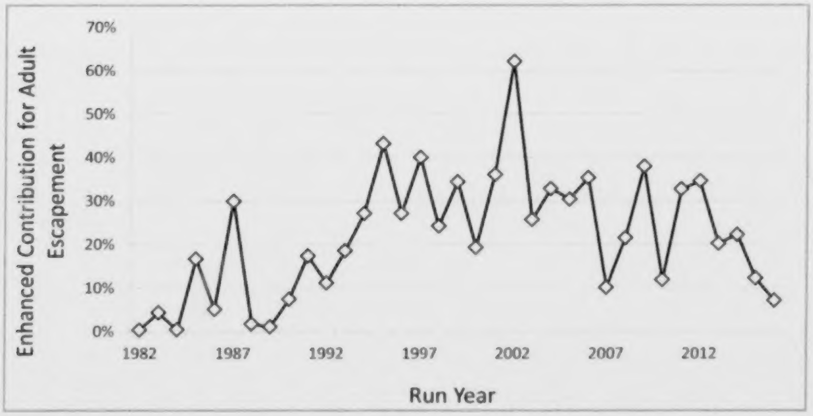


Figure 3.20.–The percentage of first generation hatchery-origin Chinook salmon in the Cowichan River adult escapement, 1982–2016.

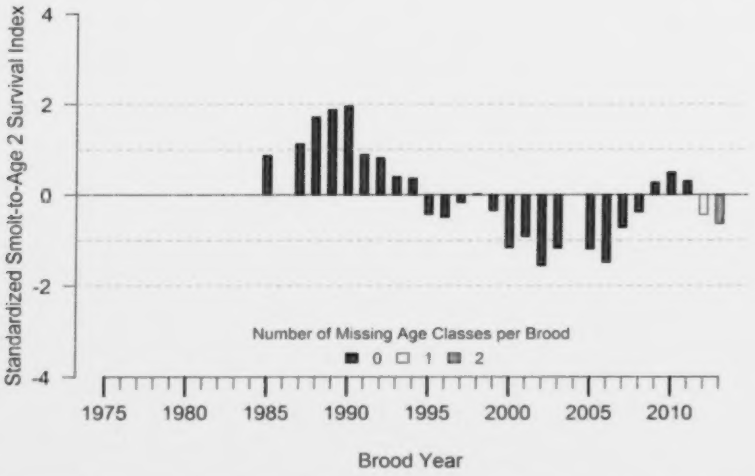


Figure 3.21.–Marine survival index (standardized to a mean of zero) for the Cowichan River stock of Chinook salmon, 1985–2013 brood years. Brood years 1986 and 2004 were not represented by CWTs, thus no data are available.

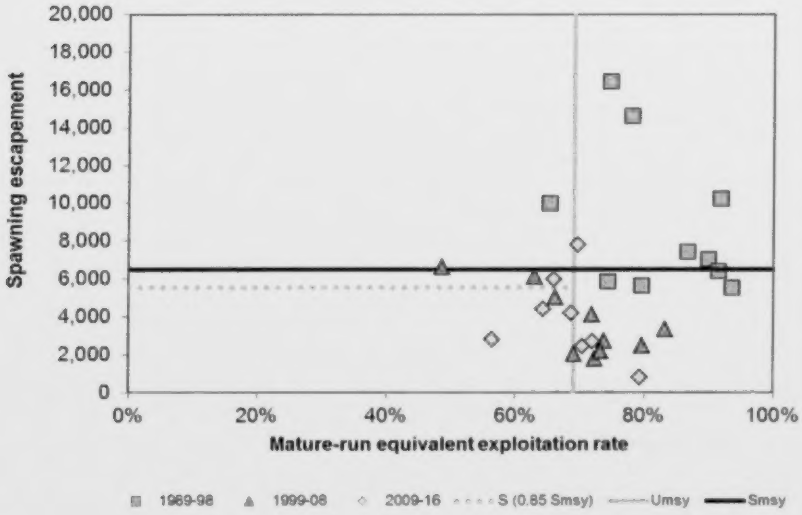


Figure 3.22.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Cowichan River stock of Chinook salmon, 1988–2016.

3.2.3.4 Fraser River Stocks

Within the Fraser River, three of five escapement indicator stocks are currently represented by exploitation rate indicator stocks. The Fraser River spring run age 1.2, Fraser River summer run age 0.3, and Fraser River late run are represented by the exploitation rate indicator stocks at the Nicola, Lower Shuswap, and Harrison rivers, respectively. Fraser River spring run age 1.3 and Fraser River summer run age 1.3 are not currently represented by CWT-based indicator stocks.

3.2.3.4.1 Fraser River Spring Run Age 1.2: Nicola River

The Fraser River spring run age-1.2 stocks are small-bodied, early-maturing stocks that spawn in tributaries to the Lower Thompson River, Louis Creek in the North Thompson River, and Bessette Creek in the South Thompson River. The Nicola River is an exploitation rate indicator stock that has escapement estimates produced by MR methods. Currently, there are no CTC-agreed escapement goals for this group. Harvest occurs almost exclusively during the return migration, while passing through approach fisheries and within the gauntlet of Fraser River fisheries. Escapement estimates declined steeply between 2003 and 2009, and currently this is a stock group of concern for Canadian fishery planning. This stock has had a high level of enhancement (mean enhanced contribution = 28%, run years 1987–2016), which influences its representativeness for unenhanced stocks in the stock group (Figure 3.23). Hatchery contribution averaged 19% over the last 12 years.

The reference lines in Figure 3.24 were estimated from habitat-based methods (Parken et al. 2006). The Nicola River stock has been in either the low escapement and low exploitation or safe zone of the synoptic plot in all years. Since 2009, the stock has been in the low escapement and low exploitation zone, which indicates that smolt survival, freshwater survival, or their interaction have contributed to low production.

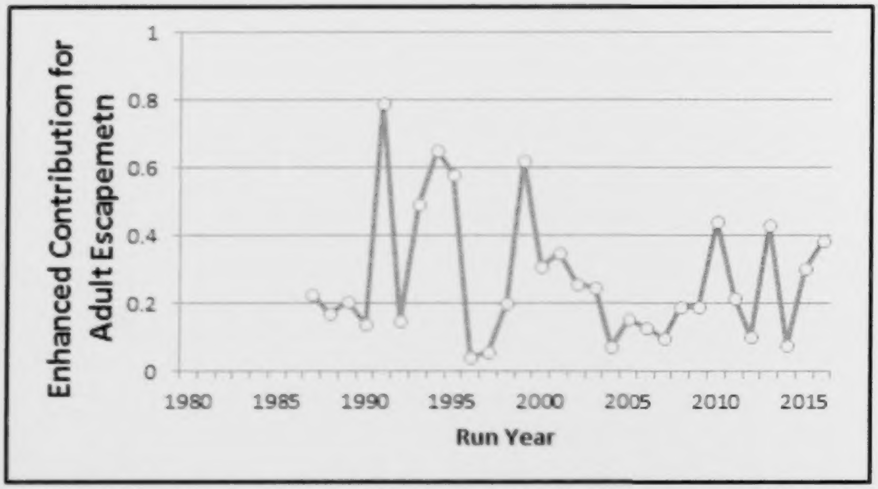


Figure 3.23.–The percentage of first generation hatchery-origin Chinook salmon in the Nicola River escapement, 1987–2016.

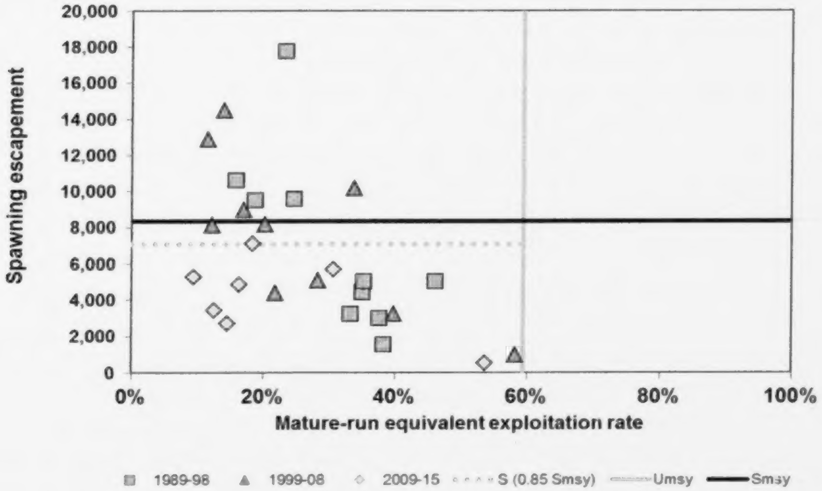


Figure 3.24.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Nicola River stock of Chinook salmon, 1995–2016.

There was a shift to a below-average marine survival regime beginning in brood year 2000, which appears similar to the pattern described previously for the outside-rearing stocks in Alaska (Figure 3.25). Cohorts that entered the ocean in 2005, 2007 and 2012 (return years 2007, 2009, and 2014) survived particularly poorly; however, 2014 returns were much more abundant, suggesting that cohort had higher freshwater production. A pattern of alternating years of very poor escapements has persisted due to the weak returns from those smolts, despite increased conservation measures. Survivals decreased steeply with the 2000 brood (2002 ocean entry) and subsequently remained below average, with the modest exception of the 2006 brood (2008 ocean entry; Figure 3.25). The very low survival for the 1992 brood year was caused by a Myxobacteria infection at Spius hatchery, and the survival for the 1994 brood year was affected by high prespawn mortality in 1998 (not measured). Rebuilding will require a sustained return to more favorable survival conditions.

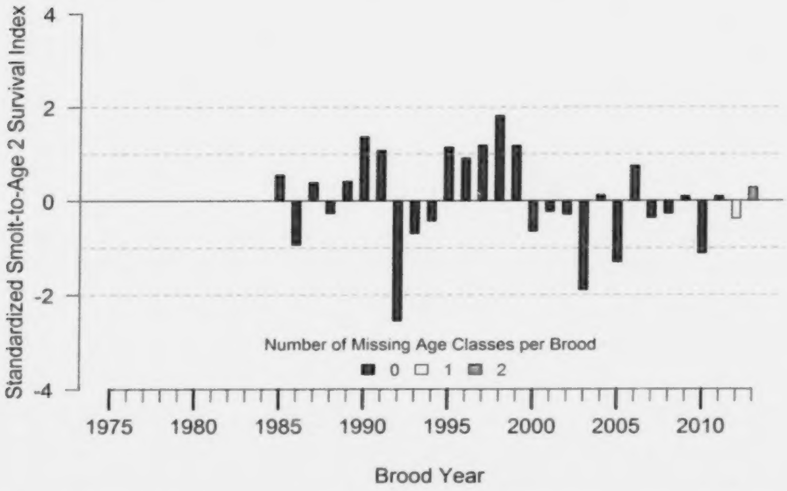


Figure 3.25.–Marine survival index (standardized to a mean of zero) for the Nicola River stock of Chinook salmon, 1985–2013 brood years.

3.2.3.4.2 Fraser River Summer Run Age 0.3: Lower Shuswap

The Fraser River summer run age-0.3 stocks are far north migrating, ocean-type stocks that spawn in Maria Slough (Lower Fraser River), the Lower Thompson River, and South Thompson River and tributaries. These fish remain on the continental shelf for their entire marine residence and are vulnerable to harvest throughout that period and during return migration, in both marine and Fraser River fisheries. Escapements to this stock group increased from about 25,000 through the 1980s to more than 100,000 between 2006 and 2011, peaking in 2010 at an estimated 156,600 fish, and declining steeply in 2012 to about 48,000 fish. Escapements have recovered since 2014, with approximately 93,000 returning in 2016. The Lower Shuswap River is an exploitation rate indicator stock that has escapement estimates produced by MR methods since 2000. Currently, there are no CTC-agreed escapement goals for this group and the reference lines were estimated from habitat-based methods (Parken et al. 2006). This stock has had a low to moderate level of enhancement (mean enhanced contribution = 10%, run years 1987–2016), which influences its representativeness for unenhanced stocks in the stock group (Figure 3.26).

Marine survival has been fluctuating since 1984; however, many of the brood years since 2000 have experienced below average survivals (Figure 3.26). Survival increased considerably for the 2010 brood year, leading to a high abundance of age-3 fish in the 2013 and age-4 fish in 2014 escapements, but has declined in subsequent broods. The cumulative exploitation rates have been below the threshold reference line in all but two years and escapements have exceeded S_{MSY} in all but three years (1993, 2012 and 2016, Figure 3.27). The Lower Shuswap CWT stock has been in the safe zone of the synoptic plot in all but five years. Since implementation of the 2009 Agreement, six years were in the safe zone and two years (2012 and 2016) were in the low escapement and low exploitation zone.

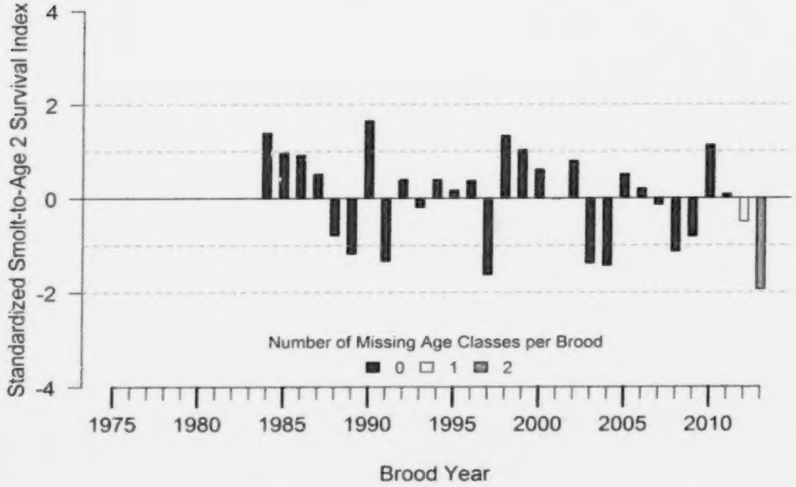


Figure 3.26.–Marine survival index (standardized to a mean of zero) for the Lower Shuswap River stock of Chinook salmon, 1984–2013 brood years.

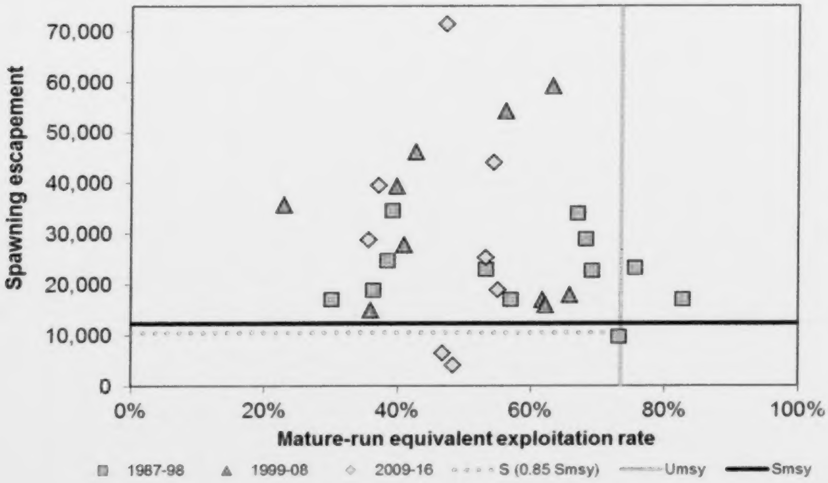


Figure 3.27.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Lower Shuswap River stock of Chinook salmon, 1989–2016.

3.2.3.5 Fraser Late: Harrison River

The Fraser late stocks are white-fleshed fall-run Chinook salmon, originating from the Harrison River downstream of Harrison Lake in the Lower Fraser River. Juveniles migrate to the Fraser estuary immediately after emergence and remain in the estuary area for up to six weeks before moving into the Strait of Georgia. Their ocean distribution is principally in the Salish Sea, WCVI, and Coastal Washington, where they are vulnerable to fisheries throughout their ocean residence. The stock group was represented originally by the Chilliwack River exploitation rate indicator stock, but recently data have been reported for the Harrison River indicator stock that has escapement estimates produced by MR methods since 1984. From 1984 to 2016, the enhanced contribution to this stock has averaged 4% (range = 0.3–17%). With a few exceptions, marine survivals have been below average since 1990 (Figure 3.28). Spawning escapements have been below the goal range for four of the past eight seasons and one was in the buffer zone (Figure 3.29). The synoptic plot shows the stock with exploitation rates higher than the reference line in the majority of years from 1985 to 1998, with two years in the high risk zone but only one year in the safe zone. Cumulative exploitation rates were reduced under the 1999 Agreement, with the majority of years having exploitation rates less than U_{MSY}. Exploitation rates were further reduced under the 2009 Agreement and exploitation rates have been below the reference line; however, only three years have been in the safe zone since 2009. The recent low escapements and low exploitation rates indicate that smolt survival, freshwater survival, or their interaction have contributed to low production.

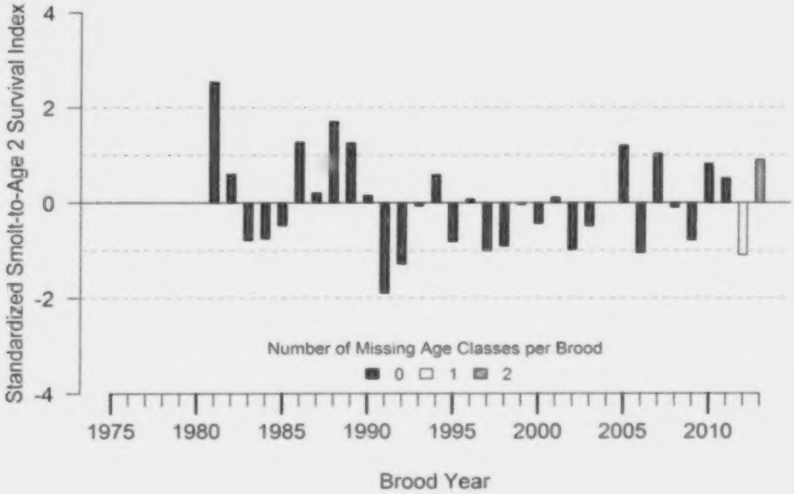


Figure 3.28.–Marine survival index (standardized to a mean of zero) for the Harrison River stock of Chinook salmon, 1981–2013 brood years. No data are available for brood year 2004.

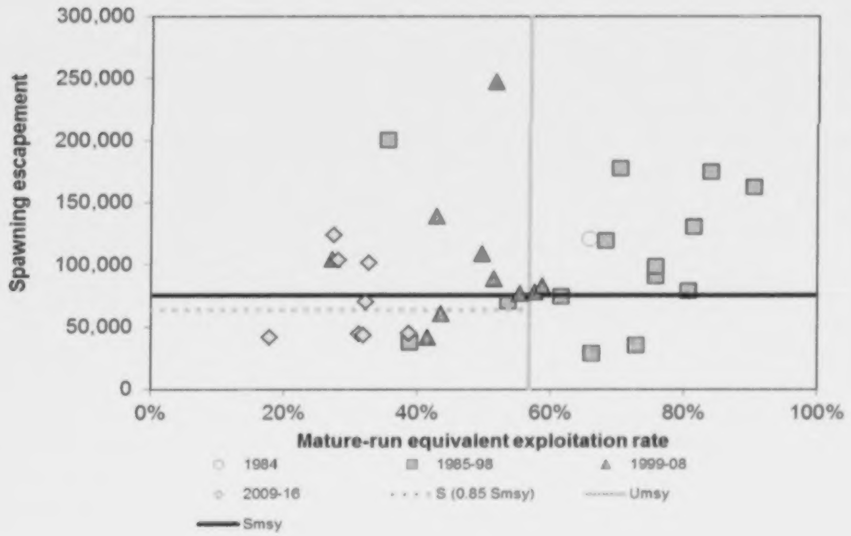


Figure 3.29.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Harrison River stock of Chinook salmon, 1984–2016.

3.2.4 Puget Sound, Coastal Washington, Columbia River, and Coastal Oregon Stocks

3.2.4.1 Puget Sound

Puget Sound stocks are a mixture of natural- and hatchery-origin production of spring run and summer/fall run fish that influences both the fisheries within Puget Sound, and escapement to the spawning grounds. The hatchery stocks contribute to terminal fisheries and in some cases many hatchery strays escape to the spawning grounds. Consequently, historic patterns of wild Puget Sound Chinook salmon abundance may be obscured because of the interaction of hatchery- and natural-origin production in the fishery and escapement accounting. Hatchery programs in Puget Sound have annually released between about 23 million (1976) to over 56 million (1989) Chinook salmon (Figure 3.30). Since Puget Sound Chinook salmon were listed as threatened under the ESA in 1999, hatchery production has averaged about 33 million releases annually. Although Puget Sound hatchery programs historically emphasized production for fisheries alone, many of today's programs are also associated with endangered species recovery or wild broodstock CWT indicator programs. The harvest rate in terminal fisheries for these stocks has generally declined from between 40% and 60% in the early 1980s to about 10% at the time of listing under the ESA in 1999. In most years, the majority of the terminal fishery harvest has depended on the status of Green River Chinook salmon and to a lesser extent on Skagit River fish. Directed terminal fisheries do not occur on Snohomish River, Stillaguamish River, and Lake Washington Chinook salmon. Terminal harvest data for 2016 have not been reviewed by co-managers, although indications are that catches were similar to or slightly higher than those in 2015.

Spring run stocks in Puget Sound exhibit both ocean-type (age-0 fingerling outmigrants) and stream-type (age-1 yearling outmigrants) life histories. Key spring stocks are the CTC escapement indicators in the Nooksack and Skagit rivers, as well as the White River (CWT indicator), with associated hatchery programs in each. Escapement in the Nooksack River is predominately hatchery-origin fish, whereas on the Skagit River, hatchery-origin fish are rarely seen in the spawning areas. The majority of Chinook salmon production from Puget Sound is comprised of summer/fall run ocean-type stocks. Skagit River summer/fall Chinook salmon is the largest stock in Puget Sound, and consists almost exclusively of natural-origin fish. The Skagit and Stillaguamish rivers have CWT exploitation rate indicator stocks but only Stillaguamish has a supplementation program that uses broodstock collected from the spawning grounds. Basins with large hatchery programs include the Snohomish and Green CTC escapement indicators as well as the Samish, Puyallup, Nisqually and Skokomish rivers. In addition, net-pen programs in Bellingham and Tulalip bays release large number of juvenile Chinook salmon.

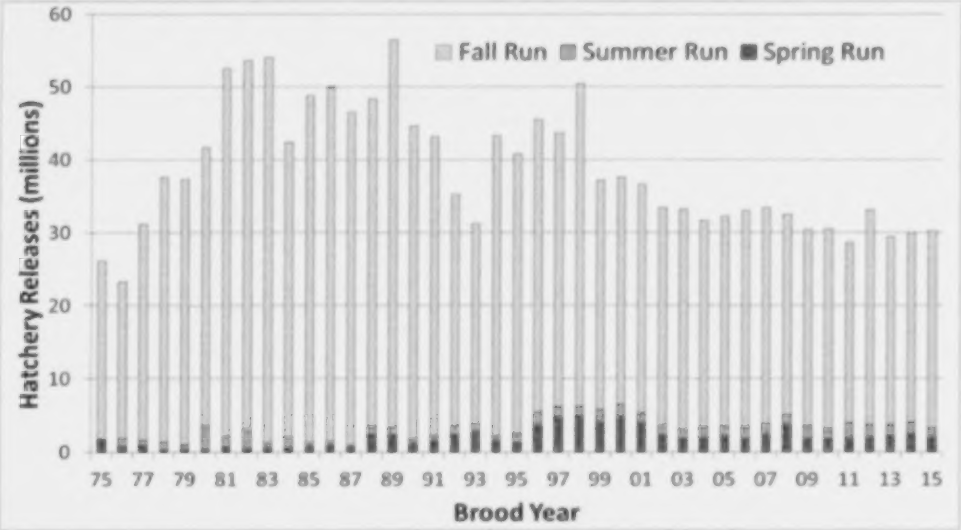


Figure 3.30.–Chinook salmon released from Puget Sound hatcheries, 1975–2015 brood years.

Estimates of total production for the Puget Sound CTC escapement indicator stocks have not been made in part because of the lack of long-term representative tag groups for the natural stocks (except Green River). The trend in the escapement of Puget Sound summer/fall CTC escapement indicator stocks is driven primarily by the status of Skagit River summer/fall stocks. In most years the abundance of Skagit River fish is higher than the sum of the escapements of other Puget Sound CTC indicator stocks. This is especially true when the escapement of Skagit River summer/fall Chinook salmon averaged 17,900 from 2000 to 2006, and exceeded 20,000 from 2004 to 2006. For the period of 1975 to 2014, the aggregate escapement of Puget Sound summer/fall indicator stocks has ranged from a low of about 12,000 in 2009 and 2011, to a high of 45,000 in 2004 (Figure 3.31). The aggregate escapement was 34,125 in 2016, which is the highest aggregate escapement since 2006. None of the Puget Sound Chinook salmon stocks have CTC-accepted escapement goals.

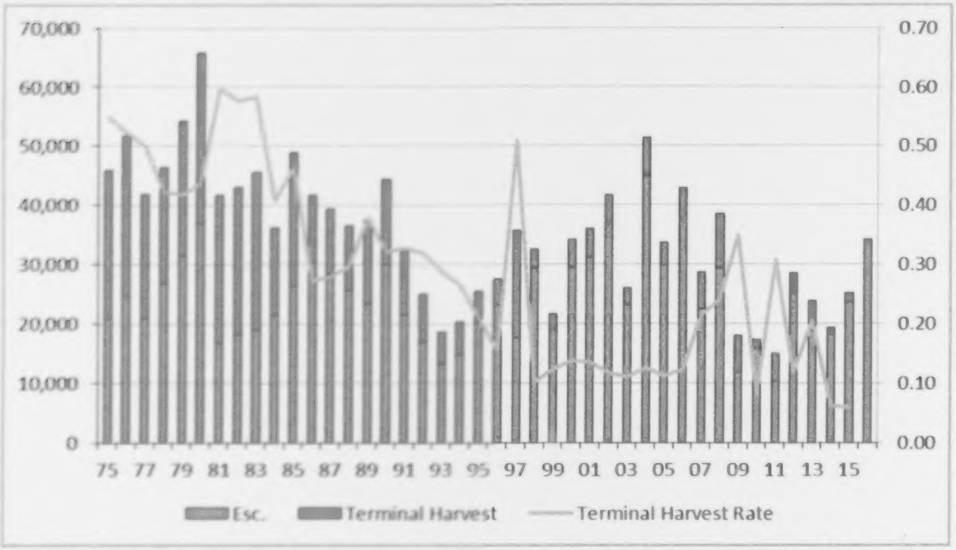


Figure 3.31.–Escapement and terminal fishery harvest for the aggregate of Puget Sound summer/fall Chinook salmon PSC escapement indicator stocks.

Note: Terminal harvest not available for last year.

The long-term escapement trends for Puget Sound Chinook salmon stocks cannot be identified with certainty because of the inability to assess total production of natural stocks in Puget Sound, coupled with the changes in fishery patterns and hatchery production over the 1975 to 2016 time period. Data limitations notwithstanding, it is still possible to make some generalizations about the current status of Puget Sound escapement indicators based on the recent past at both the aggregate and individual population levels. Spring Chinook salmon in the Nooksack and Skagit rivers, for example, exhibit annual variability with no apparent escapement trend. Overall, aggregated summer/fall escapements have declined from near-peak levels in the recent decade similar to the declines of the 1990s that led to ESA listing, but have been increasing in recent years. Some variation on this general theme emerges at the individual stock level (Section 2.3.4). The average summer/fall escapement in 2009–2015 was about 23% lower than the long-term average during 1999–2015 with exception of Lake Washington that remained nearly the same (Appendix B7). Although it is important to acknowledge the influence of the time period choice on conclusions about recent abundance trends (i.e., near-record escapements were seen for many Puget Sound populations in the early 2000s), the observation of low escapements in recent years for multiple populations suggests this group of stocks remains depressed overall. Future assessments of escapement trends should attempt to separate hatchery strays from natural-origin spawners, where data permit.

3.2.4.2 Coastal Washington

Coastal Washington is the only region in the state accessible to anadromous salmonids where Chinook salmon are not listed under the U.S. Endangered Species Act. Consequently, salmon fishery management of the coastal Chinook salmon stocks in this region has one less regulatory framework to consider, but still has to balance conservation needs with state and tribal co-management, federal fishery management plans, and international agreement under the PST. Additionally, compared to Puget Sound, the confounding influence of hatchery production on trend assessments is considerably less.

The aggregate escapement of spring and summer Chinook salmon CTC escapement indicator stocks in the Quillayute, Hoh, and Queets rivers and Grays Harbor ranged from a high of 11,740 in 1989 to a low of 2,316 in 2007 (Figure 3.32). Queets River spring/summer and Quillayute River summer Chinook salmon populations have not met escapement goals in the majority of years since 1999, and both the Quillayute and Hoh stocks exhibit escapement trends indicating considerable decline since the late 1980s but stability since the 1999 PST went into effect (Section 2.3.4.2). Terminal harvest rates on these stocks have averaged less than 15% since the mid-1990s, and were 11% in 2015. There is no CTC indicator representative of this stock group. However, Chinook with CWTs were released from Sol Duc Salmon Hatchery in the Quillayute Basin in the early 1990s and discontinued for about 10 years before starting new tagging programs with the 2004 brood. Based on limited information from these tag recoveries that generally showed poor survival, the Quillayute stock has a northerly ocean catch distribution. Exploitation rates cannot be determined because recoveries are low and escapement area sampling appears inadequate in some years.

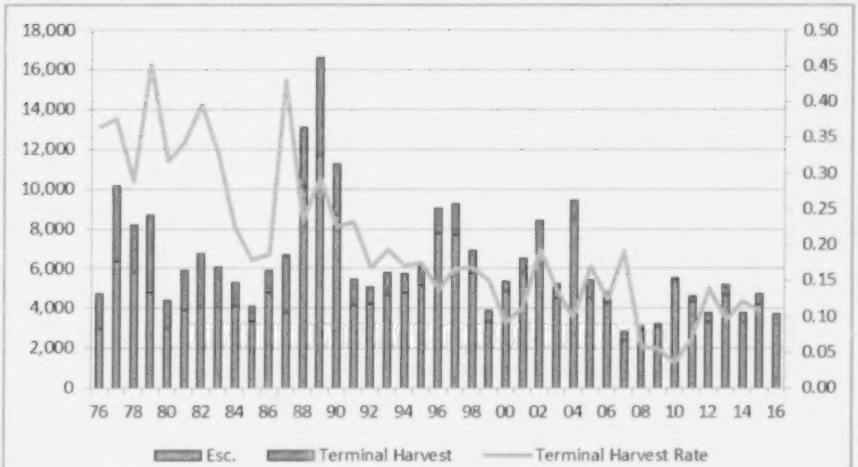


Figure 3.32.–Escapement, terminal harvest, and terminal harvest rates for the aggregate of Washington coastal spring/summer Chinook salmon PSC escapement indicator stocks.

Note: Terminal harvest not available for last year.

Coastal Washington fall Chinook salmon escapement indicators include Quillayute, Hoh, Queets, and Grays Harbor (accepted in 2014), which have CTC-accepted escapement goals, along with the Hoko stock that only has an agency management goal. The coastal fall Chinook salmon aggregate escapement has ranged from a low of 13,801 in 1983 to a high of 57,634 in 1988 (Figure 3.33). Similar to spring/summer stocks, coastal fall stocks are characterized by escapement declines since the highs of the late 1980s, and generally stable escapements in the more recent past (Section 2.3.4.2). Over the entire 1975 to 2015 time period, terminal harvest rates have varied substantially without a definitive trend, and have averaged about 33% since 1999. With the exception of the Hoko where there are no terminal fisheries, harvest in terminal fisheries is a mixture of directed catch on Chinook salmon and incidental catch while targeting other species (Figure 3.33).

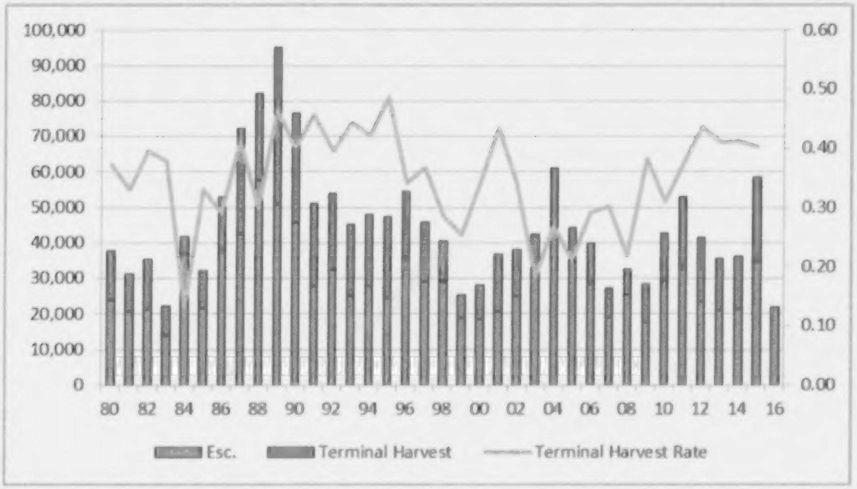


Figure 3.33.–Escapement, terminal harvest, and terminal harvest rates for the aggregate of Washington coastal fall Chinook salmon PSC escapement indicator stocks.

Note: Terminal harvest not available the last year.

Fall Chinook salmon hatchery production is more limited on the Washington Coast, compared to Puget Sound, and not extensive in the CTC indicator stock basins. The current fall Chinook salmon hatchery programs include the Hoko Falls Hatchery that releases smolts for natural stock supplementation/CWT indicator stock purposes, Salmon River Fish Culture Hatchery in the Queets Basin, and Humptulips Salmon Hatchery in the Grays Harbor watershed. Other significant programs outside of the CTC escapement indicator stock programs include releases from Makah National Fish Hatchery on Tsoo-Yess River (formerly Sooes River), and Forks Creek Hatchery in Willapa Bay. All of these hatchery programs influence the management of terminal fisheries and the extent of directed harvest on fall run Chinook salmon.

Despite a lack of clear trends in escapement for coastal Chinook salmon stocks (Section 2.3.4.2), conclusions on stock status and population trend are speculative without a full run reconstruction (CWT-based) that can account for total production. Ocean fishery impacts for these stocks, however, can be estimated using the Queets CWT indicator tag releases. From a simple fishery distribution basis, the portion of the Queets stock impacted in ocean fisheries shows no apparent temporal trend and has averaged about 40% of the total accounting in all fisheries and escapement from 1985 to 2014 (CTC 2017). Since ocean fishery impacts show no temporal trend and terminal returns have declined since the late 1980s, it appears that total adult production has also declined. Further investigation and analysis is needed to confirm this generalization.

Queets CWT indicator tag releases were used to produce plots for a synoptic evaluation of three coastal Washington fall Chinook salmon stocks with CTC-accepted escapement goals—Quillayute, Hoh, and Queets rivers. A synoptic plot was not produced for Grays Harbor because of the short time since the escapement goal was accepted by the CTC. Queets CWT releases are assumed to be representative of the exploitation and ocean distribution of Quillayute and Hoh stocks. All three stocks have active terminal fisheries with similar terminal fishery harvest rates; therefore, Queets CWTs are considered a suitable surrogate to estimate exploitation in the Quillayute and Hoh rivers.

A simultaneous evaluation of spawning escapement and cumulative MRE exploitation rates shows management of Queets River fall Chinook salmon (Figure 3.34) in the safe zone with spawning escapement exceeding the goal and exploitation rates below S_{MSY} in all years except 1999 and 2007. Management for escapement and MRE exploitation rate was in the safe zone in all years for Quillayute (Figure 3.35) and Hoh (Figure 3.36) rivers. Productivity of these stocks is high, evidenced by their high U_{MSY} (0.87 for Queets and Quillayute; 0.90 for Hoh), which provides for less stringent management than some stocks with lower U_{MSY}. From this synoptic evaluation perspective, these coastal Washington stocks exhibit a track record of sustainable management. Further, this view of the fishery impact and escapement data suggests that much of the variation in escapements for these stocks has been driven by non-fishing factors (e.g., anomalously high or low marine survival).

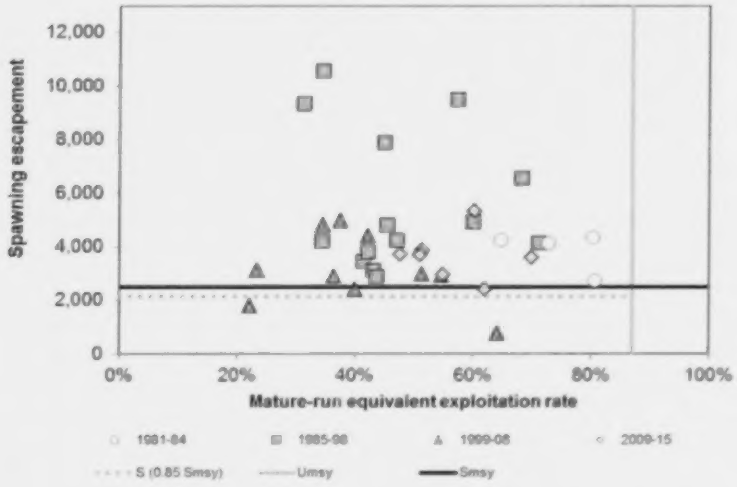


Figure 3.34.–Queets River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

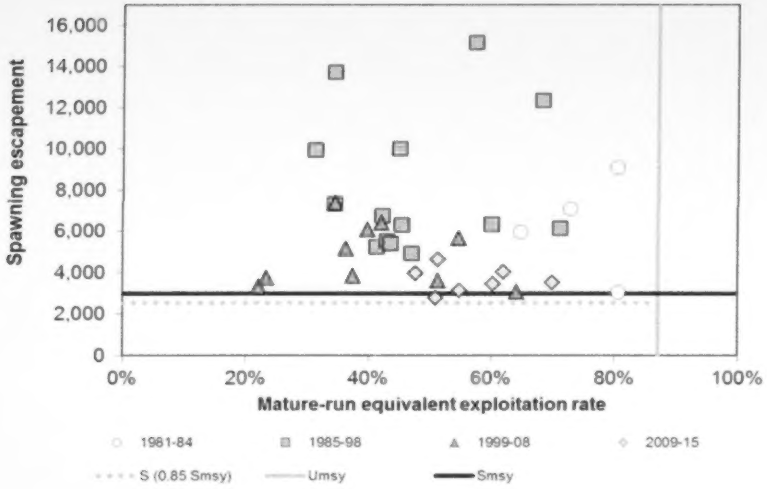


Figure 3.35.–Quillayute River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

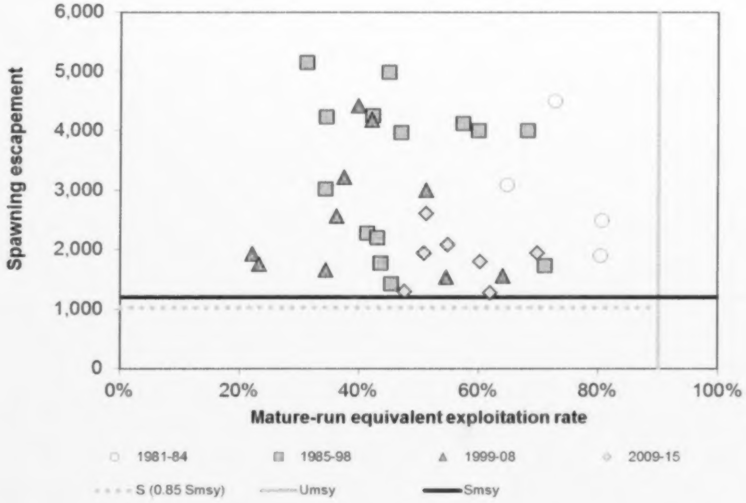


Figure 3.36.–Hoh River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Queets River PSC indicator CWTs.

3.2.4.3 Columbia River

3.2.4.3.1 Columbia River Summers

Mid-Columbia Summer Chinook is the only escapement indicator stock in this stock group. Since 2008, Mid-Columbia Summer Chinook have been managed for a spawning escapement of 17,000, and an additional 3,000 fish for hatchery brood stock, using a sliding scale of harvest rates based on expected terminal run size.

The synoptic evaluation shows Rock Island Dam counts as escapement. These counts have exceeded 40,000 since 2009, while the stock experienced MRE exploitation rates of 51% to 71%. The CTC goal of 12,143 summer Chinook salmon past Rock Island Dam was developed prior to sport and nontreaty tribal fisheries that now take place above Rock Island Dam, so the dam counts are consistent with the goal but overestimate escapement. In 2016, Colville tribal catches above Rock Island Dam were 3,541 and sport catches above Priest Rapids Dam were 4,214, so escapement was still well above goal. The synoptic evaluation shows the Columbia Upriver Summer stock group in the safe zone from 2009 to 2013, and in the high escapement–high exploitation rate zone in 2014 and 2015 (Figure 3.37). Columbia Upriver Summers have demonstrated normal variation in survivals (within 2 standard deviations for all but one brood years). Although survivals have been predominantly positive since 1998, the age-2 survival index for brood year 2010 (Figure 3.38) fails to show the large positive deviation demonstrated by Columbia River fall stocks (Figure 3.42).

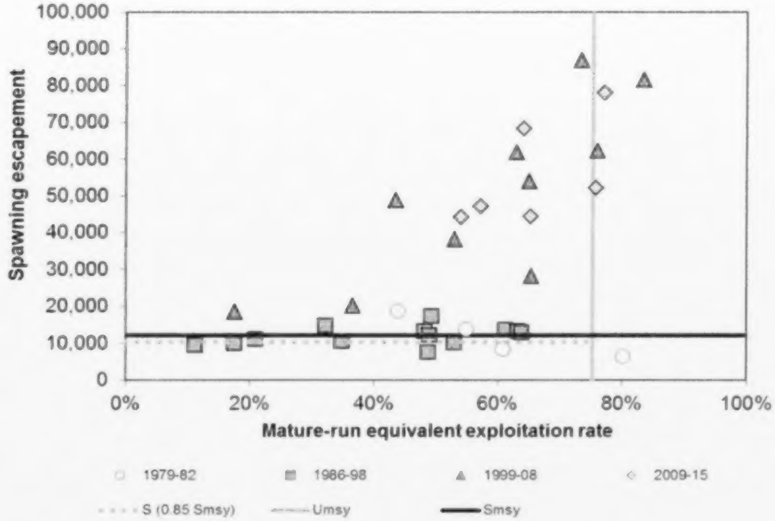


Figure 3.37.–Columbia Upriver Summer Chinook salmon spawning escapement past Rock Island Dam and cumulative mature-run equivalent exploitation rate calculated from Wells Hatchery PSC indicator CWTs.

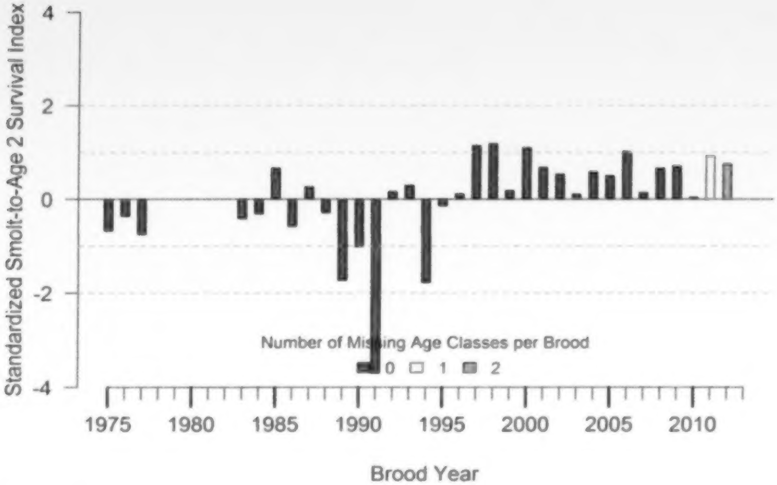


Figure 3.38.–Marine survival index (standardized to a mean of zero) for Columbia Upriver Summer Chinook salmon.

3.2.4.3.2 Columbia River Fall

The Columbia River Falls stock group has three escapement indicator stocks: Upriver Brights, Deschutes, and Lewis. The Upriver Bright management unit is comprised of all bright fall Chinook populations returning above Bonneville Dam, including those in the Deschutes, upper Columbia and Snake rivers. CTC-accepted goals have been met since 1983 for the Upriver Bright indicator stock, and since 1993 for the Deschutes River indicator stock, while MRE exploitation rates based on the Upriver Bright indicator have varied widely between 36% and 88% since 1983 (Figure 3.39, Figure 3.40). The synoptic evaluations show management of Upriver Brights (Figure 3.39) and Deschutes River (Figure 3.40) fall Chinook in the safe zone or the high escapement/high exploitation zone in all years since 1998.

The CTC accepted escapement goal for Lewis River fall Chinook salmon has been met since 2009 and exploitation rates since 1980 have never exceeded the estimated U_{MSY}, so the synoptic evaluation shows management of Lewis River Fall Chinook in the safe zone since 2010 (Figure 3.41).

Standardized survival indices for Columbia River falls have been positive based on wild Hanford Reach CWT data, and Priest Rapids Hatchery CWT data (Figure 3.42 and Figure 3.43) for the 2009 through 2012 broods. Standardized survivals for Lewis River wild fall Chinook were near average for brood years 2007–2010, followed by negative and positive standardized survivals for brood years 2011 and 2012 respectively (Figure 3.44).

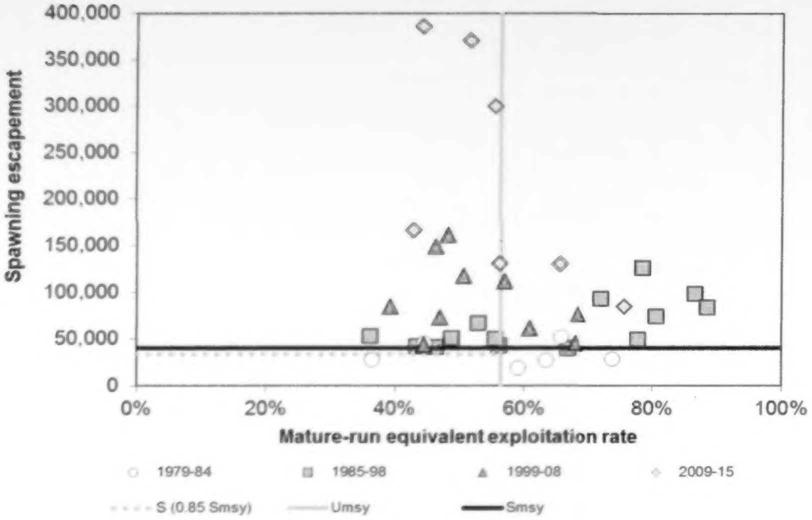


Figure 3.39.– Upriver Bright fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Priest Rapids Hatchery PSC indicator CWTs.

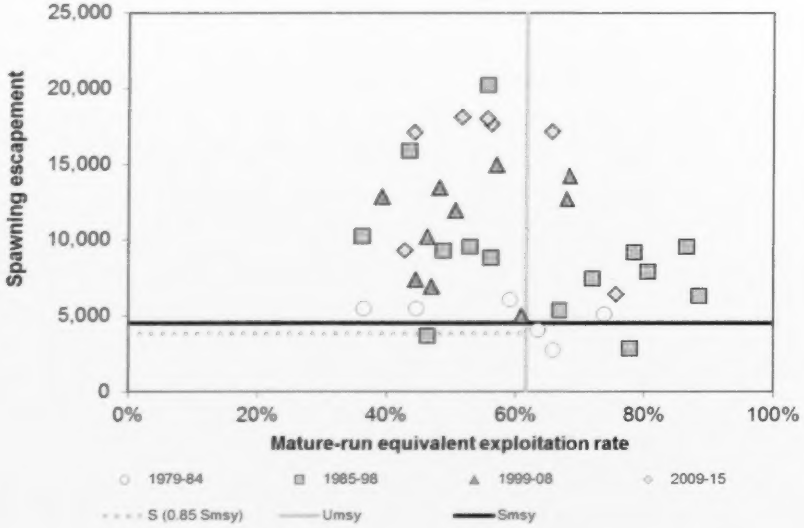


Figure 3.40.–Deschutes River fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Priest Rapids Hatchery PSC indicator CWTs.

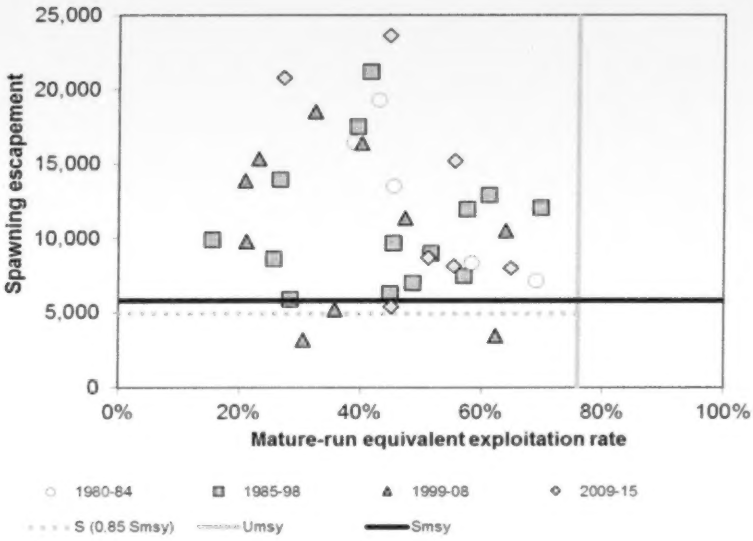


Figure 3.41.–Lewis River Wild fall Chinook salmon spawning escapement and cumulative mature-run equivalent exploitation rate calculated from Lewis River Wild PSC indicator CWTs.

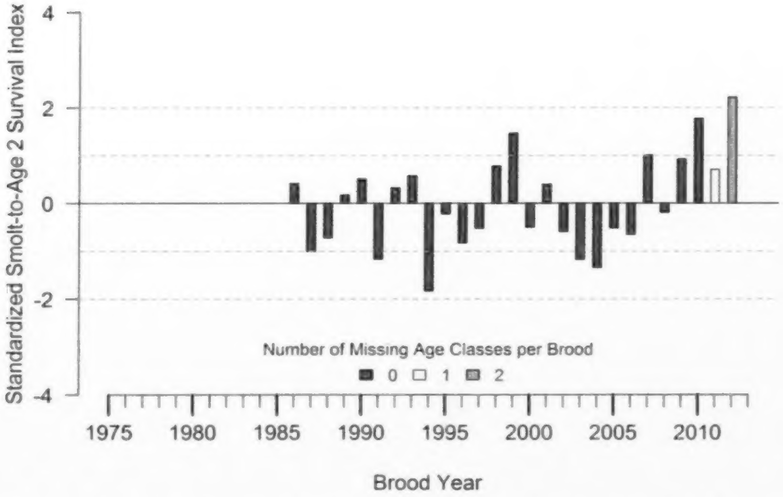


Figure 3.42.–Marine survival index (standardized to a mean of zero) for Upriver Bright Chinook salmon, as represented by Hanford Reach Wild Chinook salmon.

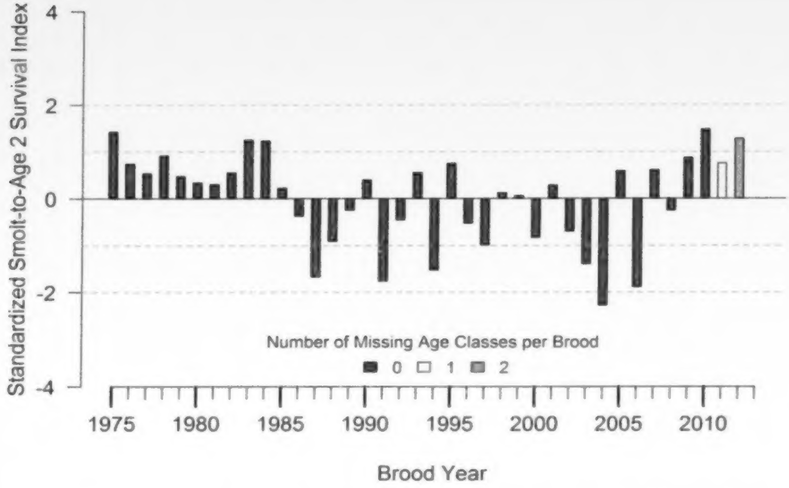


Figure 3.43.–Marine survival index (standardized to a mean of zero) for Upriver Bright Chinook salmon, as represented by Priest Rapids Hatchery Chinook salmon.

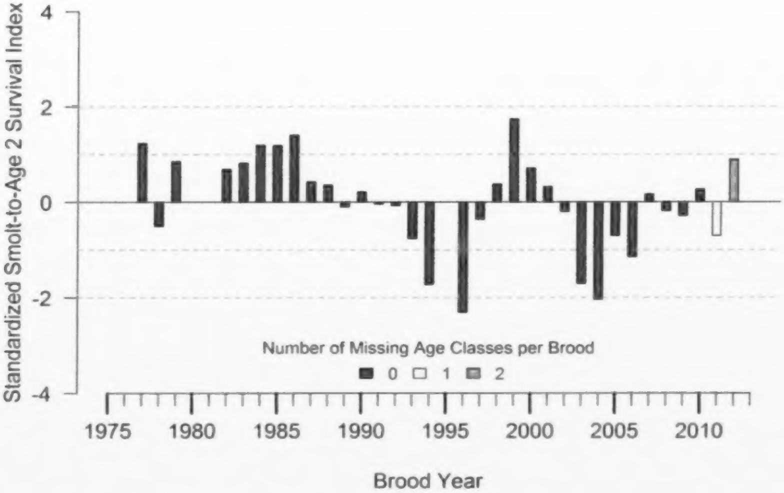


Figure 3.44.–Marine survival index (standardized to a mean of zero) for Lewis River Wild fall Chinook salmon.

3.2.4.4 Coastal Oregon

3.2.4.4.1 Oregon Coastal North Migrating

Total estimated spawning escapement for the NOC aggregate stock has ranged from approximately 39,000 Chinook salmon in 2008 to 190,000 in 1988. The recent 10-year (2007–2016) average for aggregate escapement is approximately 90,000. Estimated escapement in

2016 was 103,789. The abundance forecast expressed in terms of spawning escapement is approximately 80,311 for 2017.

After low escapements from 2007 to 2009, the NOC stock aggregate has returned to average or above-average escapement from 2013 onwards. All three NOC escapement indicator stocks—the Nehalem, Siuslaw, and Siletz stocks—failed to achieve their escapement objectives in 2007 and 2008. The Nehalem stock did not attain its goal in 2009 and 2010, but all three escapement indicator stocks exceeded their escapement objectives in 2016 and are forecasted to reach or exceed their objectives in 2017. It is likely that the NOC has recently experienced a period of higher-than-normal marine survival, as indicated in Figure 3.45. The later years in the survival index are generated from incomplete broods, and although tempting to interpret these initial signals in both fisheries recruitment and robust escapement, these results are only preliminary.

Management actions in terminal fisheries, along with reductions in AABM fisheries, and better-than-average survival rates (Figure 3.45) appear to have contributed to the increased escapements following a period of escapement decline in the 2007–2009 return years.

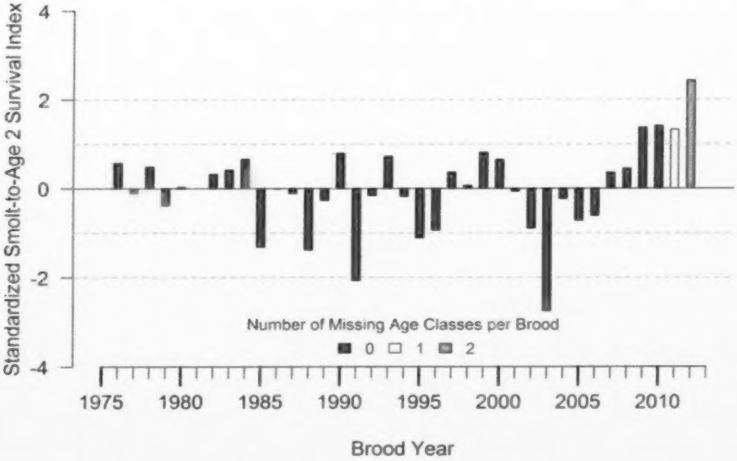


Figure 3.45.–Marine survival index (standardized to a mean of zero) for the Salmon River hatchery stock of Chinook salmon.

Note: Brood years 1976–2011 are shown, with the exception of 1981, for which there is no information.

The MRE exploitation rates in the synoptic plots (Figure 3.46–Figure 3.48) are based on the exploitation of the Salmon River Hatchery stock, the exploitation indicator stock for the NOC aggregate. Because there is a directed, high-intensity terminal fishery for hatchery-origin fish returning to the Salmon River Hatchery, exploitation on the Salmon River Hatchery stock is more intense than in terminal fisheries for NOC escapement indicator stocks. For that reason, the synoptic plots representing the Nehalem, Siletz, and Siuslaw stocks are depictions of worst-case scenarios in regards to exploitation rates. Analysis is ongoing to estimate MRE exploitation rates specific to the NOC escapement indicator stocks as used for other stocks in this report. A scan of the synoptic plots shows that three NOC escapement indicator stocks have spent most years in the upper left sector. Exploitation rates have been lower and escapements have been higher than required for MSY for the majority of years in each stock. Of the three stocks, the

Nehalem stock has spent more years below the escapement objective than the others, and the Siuslaw stock has the most years with high exploitation rates. While Figure 3.48 indicates higher-than-optimal exploitation rates for the Siuslaw stock occurred about half the time, it should be viewed with the knowledge that those exploitation rates represent a worst-case scenario, and are currently being represented by the terminal impacts incurred by the Salmon River CWT indicator stock and not the terminal harvest impacts experienced within the Siuslaw basin.

The Nehalem River stock of Chinook salmon has experienced a wide array of both exploitation and escapement from 1979 to 2015 (Figure 3.46 From 2006 to 2010 this stock failed to meet 85% of its escapement goal (Figure 3.47). Since 2011, escapements have shown an upward trend. Since 2009, the Nehalem River stock has been in either the safe or low escapement/low exploitation zones of the synoptic plot in all years. Additional analysis is needed to account for different terminal exploitation experienced between this stock and its model stock counterpart, the Salmon River Hatchery stock.

The Siletz River stock of Chinook salmon exhibit high productivity as demonstrated by one of the higher U_{MSY}s presented in this chapter. Most of the observed points of escapement and exploitation are within the safe zone, with the likelihood that exploitation rates are overestimated. Recent year's escapements (2010–2015) have increased over lower escapements observed in return years 2007 to 2009.

The Siuslaw stock of Chinook salmon, similar to the Nehalem stock, has experienced a wide array of both escapement and exploitation since 1979 (Figure 3.48). Most of the observations of escapement below S_{MSY} occurred during the pre-Treaty period of 1979 to 1984. Since 2009, this stock has met or exceeded its escapement goal despite exceeding the U_{MSY} threshold in 2 years.

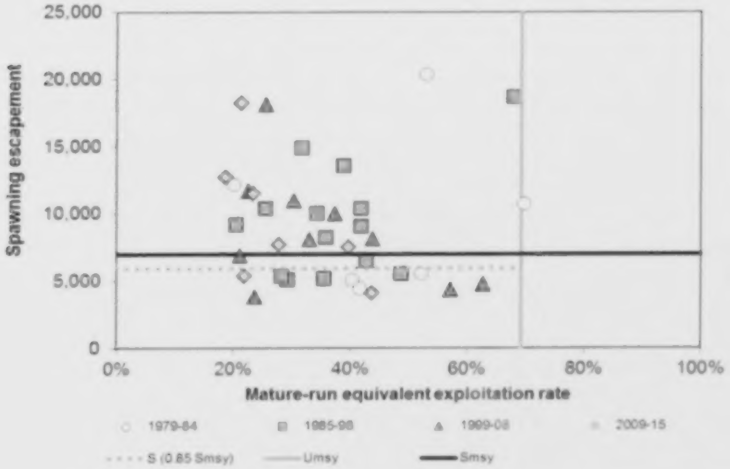


Figure 3.46.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Nehalem River stock of Chinook salmon, 1979–2015.

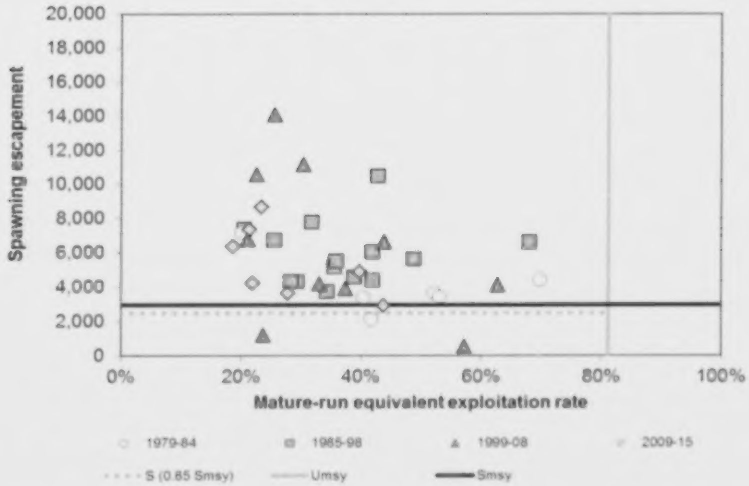


Figure 3.47.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Siletz River stock of Chinook salmon, 1979–2015.

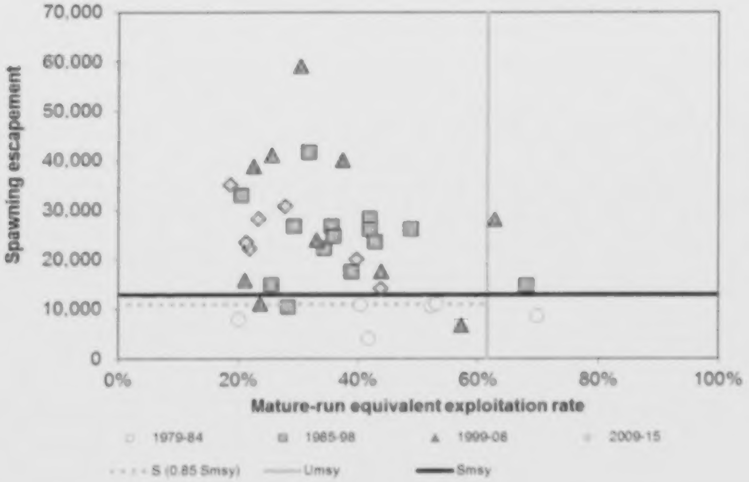


Figure 3.48.–Mature-run equivalent exploitation rate, spawning escapement, and threshold reference lines for exploitation rate and spawning escapement by CY for the Siuslaw River stock of Chinook salmon, 1979–2015.

3.2.4.4.2 Mid-Oregon Coast

After a period of declines in escapement from 2005 to 2008, the MOC stock aggregate rebounded to historical averages during the 2010–2016 return years. Total aggregated estimated escapement for the MOC has ranged from a low of 6,981 in 1976 to a high of 56,021 in 2010. The 10-year average (2007–2016) escapement for the MOC is about 29,000. Estimated escapement for the MOC stock group in 2016 was about 18,000. Forecasted escapement for the 2017 return year is quite similar to the observed 2016 values at about 18,000 spawning adults. Last year's narrative warning that the two most recent marine survival brood year metrics showed below average survival and would translate into reduced expectations for this aggregate's production have proven true. Just over half of the 2015 observed return was seen in the 2016 return year. Despite the most recent indication that marine survival is on the upswing for this aggregate (Figure 3.49), there is call for skeptical portrait of expectations for the coming year's terminal return in 2017.

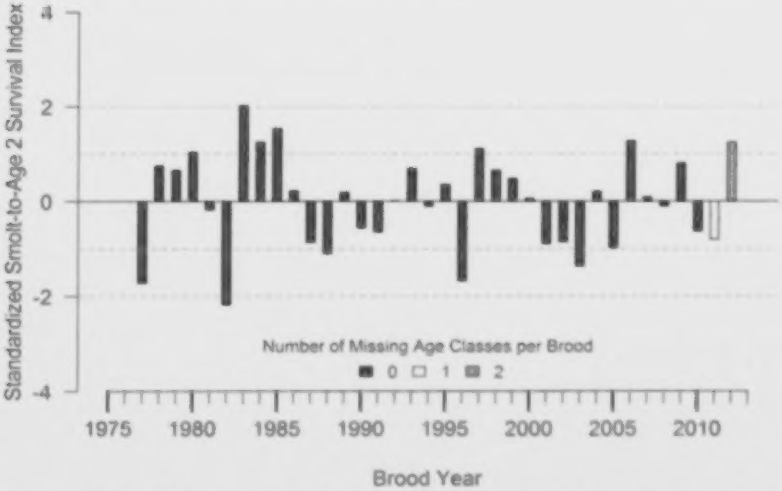


Figure 3.49.–Marine survival index (standardized to a mean of zero) for the Elk River hatchery stock of Chinook salmon.

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Table A1.–Southeast Alaska AABM Chinook salmon catches.

Year	Southeast Alaska						
	Troll	**Net**	**Sport**	**Total**	**Add-on**	**Terminal Exclusion**	**Treaty Catch**
1975	287,342	13,365	17,000	317,707	NA	NA	NA
1976	231,239	10,523	17,000	258,762	NA	NA	NA
1977	271,735	13,443	17,000	302,178	NA	NA	NA
1978	375,919	25,492	17,000	418,411	NA	NA	NA
1979	337,672	28,388	16,581	382,641	NA	NA	NA
1980	303,643	20,114	20,213	343,970	NA	NA	NA
1981	248,782	18,952	21,300	289,034	NA	NA	NA
1982	241,938	46,992	25,756	314,686	NA	NA	NA
1983	269,821	19,516	22,321	311,658	NA	NA	NA
1984	235,622	32,405	22,050	290,077	NA	NA	NA
1985	215,811	33,870	24,858	274,539	6,246	NA	268,293
1986	237,703	22,099	22,551	282,353	11,091	NA	271,262
1987	242,562	15,532	24,324	282,418	17,095	NA	265,323
1988	231,364	21,788	26,160	279,312	22,525	NA	256,787
1989	235,716	24,245	31,071	291,032	21,510	NA	269,522
1990	287,939	27,712	51,218	366,869	45,873	NA	320,996
1991	264,106	34,864	60,492	359,462	61,476	NA	297,986
1992	183,759	32,140	42,892	258,791	36,811	NA	221,980
1993	226,866	27,991	49,246	304,103	32,910	NA	271,193
1994	186,331	35,654	42,365	264,350	29,185	NA	235,165
1995	138,117	47,955	49,667	235,739	58,800	NA	176,939
1996	141,452	37,298	57,509	236,259	72,599	8,663	154,997
1997	246,409	25,069	71,524	343,002	46,463	9,843	286,696
1998	192,066	23,514	55,013	270,593	25,021	2,420	243,152
1999	146,219	32,720	72,081	251,020	47,725	4,453	198,842
2000	158,717	41,400	63,173	263,290	74,316	2,481	186,493
2001	153,280	40,163	72,291	265,734	77,287	1,528	186,919
2002	325,308	31,689	69,537	426,534	68,164	1,237	357,133
2003	330,692	39,374	69,370	439,436	57,228	2,056	380,152
2004	354,658	64,038	80,572	499,268	75,955	6,295	417,019
2005	338,451	68,091	86,575	493,117	64,326	40,154	388,637
2006	282,315	67,396	85,794	435,505	48,393	27,047	360,066
2007	268,146	53,644	82,849	404,639	68,391	8,051	328,197
2008	151,936	43,029	49,265	244,230	66,116	5,273	172,841
2009	175,644	48,465	69,565	293,674	61,907	3,733	228,033
2010	195,614	30,582	58,503	284,699	53,449	500	230,750
2011	242,193	48,220	66,575	356,988	65,580	739	290,669
2012	209,036	39,491	46,495	295,022	51,367	1,106	242,549
2013	149,541	51,319	56,392	257,252	65,558	266	191,428
2014	355,570	49,990	86,942	492,502	56,600	736	435,166
2015	269,862	53,718	79,759	403,339	68,094	216	335,029
2016[1]	276,432	42,263	70,777	389,472	35,104	664	353,704

Note: Troll, net, sport and total catches include catch of SEAK hatchery-origin fish and terminal exclusion catch; catches that count towards the all-gear ceiling (with hatchery add-on and terminal exclusion subtracted) are shown in the treaty catch column.

Note: NA = Not Available.

[1] Preliminary value until sport mail-out survey results are available.

Table A2.–Estimates of incidental mortality associated with Southeast Alaska AABM Chinook salmon treaty catches.

Year	Troll		Sport		Net		Total Treaty
	LIM	SIM	LIM	SIM	LIM	SIM	IM
1985	15,319	79,828	2,397	3,413	6,545	41,606	149,107
1986	21,169	63,137	1,982	2,823	6,880	25,268	121,259
1987	35,097	66,688	2,112	3,007	1,142	10,730	118,776
1988	11,997	34,995	2,315	3,297	6,563	15,046	74,213
1989	24,573	47,841	2,788	3,970	7,305	32,912	119,390
1990	20,490	49,423	4,494	15,554	3,401	16,562	109,925
1991	22,633	41,165	2,831	5,292	3,605	18,803	94,330
1992	24,737	43,468	4,832	7,129	24,728	103,344	208,238
1993	20,148	44,953	4,277	5,979	2,580	12,194	90,131
1994	24,611	45,623	2,747	6,051	8,937	39,091	127,060
1995	13,745	29,666	3,020	5,291	3,440	12,441	67,602
1996	14,576	27,280	3,404	4,242	221	427	50,149
1997	11,452	25,423	6,768	6,219	729	3,049	53,640
1998	5,791	11,728	4,479	5,246	1,173	6,860	35,278
1999	16,517	15,618	5,924	8,835	514	2,357	49,764
2000	9,746	19,040	4,525	5,593	222	536	39,661
2001	11,020	24,406	5,633	5,993	426	1,621	49,100
2002	8,440	33,248	5,690	6,089	249	1,429	55,145
2003	10,678	20,196	5,147	6,804	415	9,232	52,471
2004	14,061	15,482	7,060	7,233	4,901	4,177	52,913
2005	11,915	13,961	5,793	9,321	143	4,781	45,913
2006	10,256	17,291	6,106	8,706	222	5,393	47,975
2007	10,628	21,673	5,245	8,834	4,121	20,986	71,486
2008	11,717	16,590	4,608	4,687	244	290	38,134
2009	11,623	18,366	4,818	6,435	137	3,595	44,973
2010	12,763	16,944	3,754	4,559	145	264	38,428
2011	10,394	14,811	6,144	7,230	377	2,638	41,595
2012	7,315	22,799	3,703	4,948	1,410	5,710	45,885
2013	14,564	14,926	6,662	8,381	2,994	11,883	59,411
2014	14,441	16,444	6,376	7,950	104	5,630	50,944
2015	10,761	11,747	7,538	8,192	1,859	9,051	49,148
2016[1]	9,828	20,898	7,228	7,854	98	8,400	54,306

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] Preliminary estimates for Sport IM and Total IM. Legal dropoffs in sport retention fishery estimated from creel estimate while all other IM for the Southeast Alaska sport fishery is estimated from the preliminary LC and the previous year IM to LC ratios. Final estimates are available from mail-out surveys in October one year post fishing season and will be reported in this appendix in the next annual catch and escapement report.

Table A3.–Estimates of incidental mortality associated with Southeast Alaska Chinook salmon total catches.

Year	Troll		Sport		Net		Total
	LIM	SIM	LIM	SIM	LIM	SIM	IM[1]
1985	15,584	81,237	2,587	3,684	6,575	41,746	151,412
1986	21,690	64,744	2,346	3,342	7,224	26,491	125,837
1987	36,565	69,648	2,531	3,604	1,200	11,058	124,607
1988	12,502	36,744	2,722	3,876	6,813	15,442	78,100
1989	25,226	49,392	3,233	4,604	8,785	39,395	130,636
1990	21,761	53,067	5,565	19,262	4,499	21,260	125,414
1991	23,659	43,731	3,794	7,092	4,548	22,738	105,561
1992	25,574	45,574	5,863	8,651	26,524	110,309	222,497
1993	20,758	46,882	4,935	6,899	3,353	15,090	97,917
1994	25,489	47,395	3,281	7,228	10,987	47,326	141,706
1995	15,106	33,534	4,225	7,403	7,970	29,946	98,184
1996	15,502	30,411	5,022	6,259	1,349	4,968	63,512
1997	11,829	26,906	9,082	8,345	1,737	7,536	65,434
1998	5,939	12,211	5,322	6,233	2,013	11,680	43,398
1999	17,101	16,419	8,033	11,980	1,419	7,068	62,021
2000	10,483	21,726	6,898	8,526	828	2,675	51,136
2001	11,668	27,697	9,105	9,686	1,383	6,027	65,566
2002	8,787	35,345	8,695	9,305	573	4,116	66,822
2003	11,085	21,501	7,252	9,585	711	12,642	62,776
2004	14,742	16,618	10,266	10,516	6,959	5,776	64,878
2005	12,572	15,151	7,919	12,742	964	7,148	56,498
2006	10,619	18,178	7,552	10,766	849	8,636	56,600
2007	11,136	23,598	6,975	11,749	6,828	33,435	93,720
2008	12,336	18,551	6,963	7,081	734	1,102	46,768
2009	12,141	19,722	6,964	9,302	389	7,498	56,016
2010	13,236	17,991	4,956	6,018	501	1,243	43,946
2011	10,783	15,769	7,580	8,921	1,104	7,325	51,482
2012	7,631	24,603	4,565	6,099	4,432	18,192	65,522
2013	15,073	15,702	8,675	10,914	10,506	41,354	102,223
2014	14,749	16,916	12,278	15,447	452	9,632	69,474
2015	11,107	12,261	9,225	10,025	4,892	23,284	70,795
2016[2]	9,981	21,532	8,187	8,896	280	11,695	60,571

[1] Includes total treaty, terminal exclusion, and hatchery add-on estimates of incidental mortality.

[2] Preliminary estimates for Sport IM and Total IM. Legal dropoffs in sport retention fishery estimated from creel estimate while all other IM for the Southeast Alaska sport fishery is estimated from the preliminary LC and the previous year IM to LC ratios. Final estimates are available from mail out surveys in October one year post fishing season and will be reported in this appendix in the next annual catch and escapement report.

Table A4.–Canadian Transboundary Rivers (Taku, Stikine, Alsek) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Transboundary Rivers											
	First Nations			Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	1,024		47	178		8	0			1,202		
1976	1,074		49	236			200			1,510		
1977	450		21	62			300			812		
1978	750		35	100			300			1,150		
1979	2,150		99	872			734			3,756		
1980	822		38	1,869			354			3,045		
1981	736		34	977			556			2,269		
1982	1,018		47	1,823			429			3,270		
1983	1,375		63	1,553			355			3,283		
1984	802		37	515			569			1,886		
1985	1,066		49	759			654			2,479		
1986	1,707		79	1,668			570			3,945		
1987	1,491		69	1,512			823			3,826		
1988	1,445		66	2,170			780			4,395		
1989	1,433		66	2,799			722			4,954		
1990	1,094		50	3,703			1,001			5,798		
1991	1,572		72	2,717			834			5,123		
1992	1,311		60	2,629			608			4,548		
1993	1,248		57	2,830			909			4,987		
1994	1,297		60	3,551			744			5,592		
1995	1,464		67	3,567			1,465			6,496		
1996	1,389		64	5,489			1,134			8,012		
1997	1,584		73	6,336			811			8,731		
1998	864		40	3,288			662			4,814		
1999	1,516		70	4,117			662			6,295		
2000	1,616		74	3,882			633			6,131		
2001	954		44	2,461			659			4,074		
2002	1,450		67	2,499			963			4,912		
2003	1,659		76	3,839			651			6,149		
2004	2,454		113	6,969			455			9,878		
2005	952	0	44	20,334	-	935	323	0	22	21,609		1001
2006	962	0	44	17,076	-	785	243	0	17	18,281	-	847
2007	781	0	36	14,715	-	539	145	0	10	15,641	-	585
2008	920	0	42	10,831	-	498	327	0	23	12,078	-	563
2009	940	0	43	10,031	510	944	140	0	10	11,111	510	997
2010	1,090	0	50	9,410	124	550	247	0	17	10,747	124	617
2011	999	0	46	7,769	158	570	299	275	73	9,067	433	690
2012	764	0	35	9,119	63	513	254	367	88	10,137	430	636
2013	1,454	0	67	4,858	38	283	160	197	49	6,472	235	399
2014	1,252	0	58	5,830	15	295	181	166	44	7,263	181	397
2015	1,226	0	56	5,385	0	248	225	48	25	6,836	48	329
2016	726	0	33	4,149	0	191	20	0	1	4,895	0	225

Table A5.–Northern British Columbia (NBC) AABM Chinook salmon catches.

Year	Northern British Columbia		
	Area 1-5 Troll[1,2]	Areas 1,2E, 2W Sport	Total
1975	228,121	0	228,121
1976	190,267	0	190,267
1977	130,899	106	131,005
1978	146,054	125	146,179
1979	147,576	0	147,576
1980	157,198	200	157,398
1981	153,065	184	153,249
1982	173,472	215	173,687
1983	162,837	90	162,927
1984	185,134	171	185,305
1985	165,845	600	166,445
1986	175,715	1,153	176,868
1987	177,457	2,644	180,101
1988	152,369	7,059	159,428
1989	207,679	20,652	228,331
1990	154,109	16,827	170,936
1991	194,018	15,047	209,065
1992	142,340	21,358	163,698
1993	161,686	25,297	186,983
1994	164,581	28,973	193,554
1995	56,857	22,531	79,388
1996	8	670	678
1997	83,261	27,738	110,999
1998	109,072	34,130	143,202
1999	54,097	30,227	84,324
2000	9,948	22,100	32,048
2001	12,934	30,400	43,334
2002	102,731	47,100	149,831
2003	140,497	54,300	194,797
2004	167,508	74,000	241,508
2005	174,806	68,800	243,606
2006	151,485	64,500	215,985
2007	83,235	61,000	144,235
2008	52,147	43,500	95,647
2009	75,470	34,000	109,470
2010	90,213	46,400	136,613
2011	74,660	48,000	122,660
2012	80,257	40,050	120,307
2013	69,264	46,650	115,914
2014	172,001	44,900	216,901
2015	106,703	52,200	158,903
2016	147,381	42,800	190,181

Note: troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the NBC AABM fishery.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Troll catches from 1996 to 2004 have been updated with data from DFO (2009).

Table A6.–Estimates of incidental mortality associated with Northern British Columbia (NBC) AABM Chinook salmon catches.

Year	Area 1-5 Troll[1]		Areas 1, 2E, 2W Sport		Total
	LIM	SIM	LIM	SIM	IM
1985	2,819	12,405	97	0	15,321
1986	2,987	19,637	204	0	22,828
1987	4,307	40,626	535	0	45,468
1988	4,829	40,749	1,505	0	47,083
1989	3,740	35,135	4,068	0	42,943
1990	5,195	46,172	3,248	0	54,615
1991	4,385	43,848	2,734	0	50,967
1992	4,985	49,332	3,634	0	57,951
1993	4,444	36,696	4,353	0	45,493
1994	3,709	27,882	4,524	0	36,115
1995	3,721	26,123	2,935	0	32,779
1996[2]	0	0	2,562	0	2,562
1997[2]	1,415	0	6,021	0	7,436
1998[2]	1,854	0	6,102	0	7,956
1999	920	674	3,605	0	5,199
2000	169	147	4,707	0	5,023
2001	376	276	5,955	0	6,607
2002	2,778	1,083	8,417	0	12,278
2003	4,772	740	9,519	0	15,031
2004	9,336	1,225	21,237	0	31,798
2005	7,896	446	12,221	0	20,563
2006	3,300	3,958	7,503	0	14,761
2007	2,282	3,771	7,870	0	13,923
2008	1,321	1,748	3,266	0	6,335
2009	2,069	3,625	4,011	0	9,705
2010	2,798	3,164	6,777	0	12,739
2011	7,732	1,773	9,114	0	18,619
2012	2,152	4,427	4,977	0	11,556
2013	7,236	3,390	9,300	0	19,926
2014	4,273	5,516	7,487	0	17,276
2015	5,442	2,785	13,446	0	21,673
2016	2,810	5,061	6,265	0	14,136

Note: Troll (Areas 1–5) and tidal sport (Areas 1, 2E, 2W) are the components of the NBC AABM fishery.

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

[2] Release data are not yet available for 1996 to 1998.

Table A7.–Northern British Columbia (NBC) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Area 1–5 First Nations			Area 1–5 Net			Tyee Test Fishery			Area 3–5 Sport			Area 1–5 Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	4,055		187	24,786		1,140	309		14	0		0	0		0	29,150		1,341
1976	2,791		128	15,849		729	256		12	0		0	0		0	18,896		869
1977	6,998		322	43,926		2,021	270		12	1,670		60	2,158		149	55,022		2,564
1978	5,363		247	27,731		1,276	193		9	1,668		60	6,610		456	41,565		2,048
1979	5,266		242	40,208		1,850	432		20	2,523		91	1,960		135	50,389		2,338
1980	10,121		466	26,612		1,224	283		13	3,867		139	4,515		312	45,398		2,154
1981	11,115		511	41,379		1,903	345		16	2,760		99	2,613		180	58,212		2,709
1982	13,255		610	44,844		2,063	243		11	3,760		135	2,726		188	64,828		3,007
1983	15,532		714	16,752		771	362		17	4,092		147	5,374		371	42,112		2,020
1984	11,408		525	31,072		1,429	587		27	2,300		83	3,426		236	48,793		2,300
1985	15,794		727	39,543		1,819	545		25	3,600		130	3,186		220	62,668		2,921
1986	24,448		1,125	23,902		1,099	752		35	3,950		142	4,410		304	57,462		2,705
1987	16,329		751	17,494		805	725		33	4,150		149	3,625		250	42,323		1,988
1988	21,727		999	30,620		1,409	740		34	4,300		155	3,745		258	61,132		2,855
1989	21,023		967	38,403		1,767	653		30	4,150		149	5,247		362	69,476		3,275
1990	27,105		1,247	28,220		1,298	651		30	4,300		155	4,090		282	64,366		3,012
1991	23,441		1,078	40,782		1,876	591		27	4,256		153	4,764		329	73,834		3,463
1992	27,012		1,243	35,057		1,613	554		25	6,250		225	6,182		427	75,055		3,533
1993	21,353		982	33,351		1,534	776		36	3,279		118	7,813		539	66,572		3,209
1994	15,949		734	21,691		998	521		24	3,171		114	3,093		213	44,425		2,083
1995	13,635		627	17,629		811	464		21	2,475		89	3,503		242	37,706		1,790

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	Area 1–5 First Nations			Area 1–5 Net			Tyee Test Fishery			Area 3–5 Sport			Area 1–5 Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1996	13,345		614	26,935		1,239	2,178		100	3,382		122	1,250		86	47,090	0	2,161
1997	14,610		672	18,749		862	1,578		73	0		0	0			34,937	0	1,607
1998	20,622		949	5,790		266	1,338		62	4,750		171	0			32,500	0	1,448
1999	27,399		1,260	8,123		374	2,135		98	11,700		421	0			49,357	0	2,153
2000	23,476		1,080	19,464		895	3,004		138	8,600		310	0			54,544	0	2,423
2001	23,508		1,081	22,580			2,953		136	11,000		396	0			60,041	0	1,613
2002	14,125		650	13,554		623	1,413		65	8,000		288	0			37,092	0	1,626
2003	20,950		964	13,094		602	1,636		75	8,000		288	5,711		394	49,391	0	1,929
2004	20,548		945	15,198		699	995		46	8,000		288	0			44,741	0	1,978
2005	17,553	NA	807	5,416	5,502	4,368	1,136	NA	52	8,000	0	288	0			32,105	5,502	5,515
2006	17,262	NA	794	10,571	9,904	7,968	1,178	NA	54	8,000	0	288	0			37,011	9,904	9,104
2007	14,087	NA	648	9,520	10,273	8,011	1,302	NA	60	8,000	0	288	0			32,909	10,273	9,007
2008	14,963	NA	688	4,619	3,359	2,829	1,293	NA	59	11,970	1,643	460	0			32,845	5,002	4,036
2009	13,083	NA	602	4,348	2,003	1,642	1,189	NA	55	9,177	1,703	601	0			27,797	3,706	2,900
2010	13,693	NA	630	2,191	0	101	959	NA	44	7,570	563	362	2,689	NA	186	27,102	563	1,323
2011	10,863	NA	500	3,586	0	165	976	NA	45	14,677	2,246	885	2,540	NA	175	32,642	2,246	1,770
2012	8,189	NA	377	788	3,067	2,661	575	NA	26	7,017	0	253	421	NA	29	16,990	3,067	3,346
2013	8,557	NA	394	2,126	3,163	2,739	547		25	10,259	560	458	2,024	958	324	23,513	4,681	3,548
2014	11,936	NA	549	2,632	3,317	3,023	482	NA	22	11,973	4,692	1,117	2,302	178	193	29,325	8,187	4,964
2015	17,524	NA	806	2,434	2,300	2,090	750	9	43	12,760	NA	459	3,442	NA	237	36,910	2,309	3,635
2016	9,051	NA	416	1,222	2,072	1,746	392	NA	18	10,043	2,190	710	2,246	NA	155	22,954	4,262	3,045

Note: NA = Not available.

Table A8.–Central British Columbia ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Central British Columbia																	
	First Nations			Net[1]			Troll[1,2]			Tidal Sport			Freshwater Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			40,985			135,470			NA			NA			176,455		
1976	NA			32,669			145,204			NA			NA			177,873		
1977	6,972			32,409			122,689			4,773			1,544			168,387		
1978	7,944			35,708			91,025			5,694			1,770			142,141		
1979	7,585			50,445			107,884			5,225			1,940			173,079		
1980	6,240			27,715			95,377			4,802			988			135,122		
1981	5,701			18,912			69,247			3,490			1,261			98,611		
1982	9,112			32,419			69,748			5,419			1,293			117,991		
1983	6,442			12,556			97,447			4,271			821			121,537		
1984	9,736			4,630			78,120			4,354			1,332			98,172		
1985	6,019			12,391			27,090			3,943			823			50,266		
1986	6,353			23,032			54,407			4,566			1,245			89,603		
1987	6,296			10,893			65,776			3,933			1,563			88,461		
1988	6,000			12,886			36,125			3,596			1,496			60,103		
1989	8,992			6,599			21,694			3,438			4,526			45,249		
1990	9,811			18,630			29,882			4,053			5,626			68,002		
1991	8,801			15,926			29,843			4,409			3,335			62,314		
1992	8,533			18,337			47,868			4,891			3,204			82,833		
1993	9,095			10,579			23,376			6,114			2,880			52,044		
1994	5,383			14,424			18,976			4,303			973			44,059		
1995	3,501			11,007			5,819			2,172			1,180			23,679		

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	Central British Columbia																	
	First Nations			Net[1]			Troll[1,2]			Tidal Sport			Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1996	6,922			7,201			0			2,936			3,986			21,045		
1997	9,764			3,650			9,274			8,524			1,139			32,351		
1998	6,671			5,467			2,188			5,514			779			20,619		
1999	5,440			4,342			2,073			10,300			NA			22,155		
2000	4,576			3,197			0			7,400			NA			15,173		
2001	5,435			6,465			482			7,650			1,024			21,056		
2002	3,292			4,676			0			7,330			723			16,021		
2003	3,173			2,815			0			8,385	146	325	491			14,864	146	325
2004	4,003			5,404			0			10,677	77	397	524			20,608	77	397
2005	4,180		192	6,323	15,281	11,298	0		0	9,017	302	373	809		56	20,329	15,583	11,919
2006	4,013		185	5,231	1,391	1,247	0	786	160	9,400	428	406	NA		60	18,644	2,605	2,058
2007	2,102		97	5,542	5,349	4,106	0	1,804	371	6,130	118	239	522	20	40	14,296	7,291	4,853
2008	3,018		139	1,133	181	183	9	757	155	2,909	607	201	276		19	7,345	1,545	697
2009	4,011		185	3,132	0	144	0	0	0	3,239	0	117	0		38	10,382	0	483
2010	3,710		171	1,549	0	71	0	0	0	4,043	0	146	NA		45	9,302	0	432
2011	2,323		107	4,794	0	221	0	0	0	7,701	498	356	646		45	15,464	498	728
2012	1,745		80	3,624	500	533	0	0	0	5,861	0	211	524		36	11,754	500	860
2013	3,945		181	5,301	2,044	1,728	0	430	93	4,457	0	160	1,506	0	104	15,209	2,474	2,267
2014	2,909		134	2,238	498	463	0	0	0	7,800	0	281	2,134		147	15,081	498	1,025
2015	2,780		128	5,351	1,527	1,370	0	0	0	10,597		381	1,270		88	19,998	1,527	1,967
2016	1,912	0	88	3,192	1,050	635	0	287	58	5,769	60	217	1,493		103	12,366	1,397	1,101

Note: NA = Not available.

[1] Troll and net catches from 1996 to 2004 have been updated with data from DFO (2009), catch excludes jacks and small red-fleshed Chinook salmon.

[2] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. To make comparisons to previous years more meaningful, the same catch accounting period was applied for years prior to 1998.

Table A9.–West Coast Vancouver Island (WCVI) AABM Chinook salmon catches.

Year	West Coast Vancouver Island AABM		
	Troll[1,2]	AABM Sport[3]	Total
1975	546,214	–	546,214
1976	665,010	–	665,010
1977	545,742	–	545,742
1978	568,705	–	568,705
1979	477,222	–	477,222
1980	486,303	–	486,303
1981	423,266	–	423,266
1982	538,510	–	538,510
1983	395,636	–	395,636
1984	471,294	–	471,294
1985	345,937	–	345,937
1986	350,227	–	350,227
1987	378,931	–	378,931
1988	408,668	–	408,668
1989	203,751	–	203,751
1990	297,858	–	297,858
1991	203,035	–	203,035
1992	340,146	18,518	358,664
1993	277,033	23,312	300,345
1994	150,039	10,313	160,352
1995	81,454	13,956	95,410
1996	4	10,229	10,233
1997	52,688	6,400	59,088
1998	5,140	4,177	9,317
1999	7,434	31,106	38,540
2000	64,547	24,070	88,617
2001	79,668	40,636	120,304
2002	126,383	31,503	157,886
2003	146,736	26,825	173,561
2004	176,166	39,086	215,252
2005	148,798	50,681	199,479
2006	108,978	36,507	145,485
2007	94,291	46,323	140,614
2008	95,170	50,556	145,726
2009	58,191	66,426	124,617
2010	84,123	54,924	139,047
2011	129,023	75,209	204,232
2012	69,054	65,414	134,468
2013	49,526	64,072	113,598
2014	133,499	54,875	188,374
2015	68,552	48,215	116,737
2016[4]	60,831	38,819	99,650

Note: Troll = Areas 21, 23–27, and 121–127; Net = Areas 21, and 23–27; Sport = Areas 23a, 23b, 24–27.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. The same catch accounting period was applied for years prior to 1998.

[2] Troll catches from 1996 to 2004 have been updated with data from DFO (2009).

[3] AABM sport catch 1975 to 1991 is under review. No estimate available; it is currently included in ISBM catch in Appendix A11.

[4] Including 5,000 First Nations food, social, and ceremonial troll catch; 310 Maa-nulth Treaty catch; and 6,049 T'aaq-wiihak troll catch.

Table A10.–Estimates of incidental mortality (IM) associated with West Coast Vancouver Island (WCVI) AABM Chinook salmon catches.

Year	Troll[1,2]		Outside Sport[3]		Total
	LIM	SIM	LIM	SIM	IM
1985	7,261	102,749			110,010
1986	5,954	66,075			72,029
1987	11,169	148,659			159,828
1988	16,283	169,260			185,543
1989	3,464	63,325			66,789
1990	5,064	91,521			96,585
1991	3,452	84,116			87,568
1992	5,782	95,732			101,514
1993	4,710	84,325	3,078	1,074	93,187
1994	2,551	76,372	1,217	475	80,615
1995	6,622	45,231	1,531	643	54,027
1996[4,5]					
1997[4,5]					
1998[4,5]					
1999[4]	126	432	4,272	17,081	21,911
2000[4]	1,097	2,455	2,626	3,629	9,807
2001[4]	2,321	3,601	4,397	3,271	13,590
2002[4]	3,754	5,329	4,540	1,441	15,064
2003[4]	2,509	6,126	6,297	1,216	16,148
2004[4]	2,995	4,127	5,781	1,053	13,956
2005	2,641	4,088	7,207	878	14,814
2006	2,565	3,031	4,800	1,161	11,557
2007	1,653	3,414	4,343	2,993	12,403
2008	1,631	2,863	6,269	1,549	12,312
2009	1,059	1,653	7,755	5,350	15,817
2010	1,506	1,936	10,679	1,896	16,017
2011	2,281	2,313	9,660	2,751	17,005
2012	1,214	629	10,976	3,571	16,390
2013	852	1,734	10,714	3,306	16,606
2014	2,517	2,946	8,454	3,171	17,088
2015	1,383	932	7,021	1,635	10,971
2016[6]	1,047	1,589	4,062	2,696	9,394

Note: Troll = Areas 21, 23–27, and 121–127; Net = Areas 21, and 23–27; Sport = Areas 23a, 23b, 24–27.

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. The same catch accounting period was applied for years prior to 1998.

[2] Troll and net catches from 1996 to 2004 have been updated with data from DFO, 2009.

[3] Prior to 1992, catch was not reported as inside or outside. Therefore inside catch for those years represents total tidal sport catch.

[4] First Nations catch is mainly commercial catch 1996–2004 has been updated.

[5] Release data are not yet available for 1996–1998.

[6] Including 5,000 First Nations food, social, and ceremonial troll catch; 310 Maa-nulth Treaty catch; and 6,049 T'aaq-wiihak troll catch.

Table A11.–West Coast Vancouver Island (WCVI) ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	West Coast Vancouver Island ISBM														
	First Nations[1]			Net[2]			Tidal Sport[3]			Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			19,233			NA			NA			19,233	0	0
1976	NA			17,492			NA			NA			17,492	0	0
1977	NA			13,745			NA			NA			13,745	0	0
1978	NA			25,143			NA			NA			25,143	0	0
1979	NA			35,623			7,964			NA			43,587	0	0
1980	NA			34,732			8,539			NA			43,271	0	0
1981	NA			36,411			11,230			NA			47,641	0	0
1982	NA			41,172			17,100			NA			58,272	0	0
1983	NA			37,535			28,000			NA			65,535	0	0
1984	NA			43,792			44,162			NA			87,954	0	0
1985	NA			11,089			21,587			NA			32,676	0	0
1986	NA			3,276			13,158			NA			16,434	0	0
1987	NA			478			38,283			NA			38,761	0	0
1988	NA			15,438			35,820			NA			51,258	0	0
1989	NA			40,321			55,239			NA			95,560	0	0
1990	1,199		55	29,578			69,723			NA			188,102	0	55
1991	41,322		1,901	60,797			85,983			NA			64,769	0	1,901
1992	8,315		382	9,486			46,968	28,322	8,679	NA			99,376	28,322	9.061
1993	5,078		234	28,694			65,604	37,263	11,681	NA			56,410	37,263	11.915
1994	1,515		70	2,369			52,526	26,000	8,616	NA			28,001	26,000	8,686
1995	5,868		270	458			21,675	9,797	3,377	NA			2,324	9,797	3,647

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	West Coast Vancouver Island ISBM														
	First Nations[1]			Net[2]			Tidal Sport[3]			Freshwater Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1996	–			58			2,266	1,096	367	NA			2,324	1,096	367
1997	5,726		263	208			47,355	24,667	8,004	NA			53,289	24,667	8,267
1998	7,172		330	345			55,697	28,552	9,325	NA			63,214	28,552	9,655
1999	3,591		165	112			47,163	11,319	5,428	NA			50.866	11,319	5,593
2000	–			126			5,443	13,954	3,055	NA			5.569	13,954	3,055
2001	–			11			6,354	10,684	2,490	6,198			12.563	10,684	2,490
2002	10,893		501	260			36,073	14,629	5,298	77			47.303	14,629	5,799
2003	10,000		460	9,251			51,186	25,341	8,397	NA			70,437	25,341	8,857
2004	16,696		726	12,348			61,218	29,852	9,956	26			89,381	29,852	10,682
2005	35,000		1,610	23,599	354	4,687	43,577	9,534	4,837	6,225		430	108,401	9,888	11,564
2006	28,628		1,239	20,308	228	2,584	44,025	9,638	4,888	NA		0	92,961	9,866	8,711
2007	20,098		925	26,881	88	4,031	39,368	12,060	5,032	NA		0	86,347	12,148	9,987
2008	12,159		559	8,257	2	2,677	24,855	8,914	3,426	NA		0	45,271	8,916	6,663
2009	9,026		415	9,765	0	2,201	31,921	16,641	5,398	NA		0	50,712	16,641	8,014
2010	7,485		344	1,747	372	372	24,687	12,721	4,146	NA		0	33,919	13,093	4,862
2011	22,794		1,049	21,843	355	1,337	52,131	15,539	6,581	NA		0	96,768	15,894	8,967
2012	9,700		446	10,214	521	917	25,890	13,047	4,291	NA		0	45,804	13,568	5,654
2013	1,101		51	8,854	259	597	22,272	18,275	5,046	NA		0	32,227	18,534	5,694
2014	4,395		205	19,090	53	928	28,679	19,183	5,662	NA			52,164	19,236	6,795
2015	9,743	0	495	10,131	362	751	34,668	16,968	5,650	NA			54,542	17,330	6,895
2016	14,091	0	729	5,125	925	913	26,237	27,665	7,122	NA			45,453	28,590	8,764

Note: NA = Not available.

[1] First Nations catch is mainly commercial catch, 1996 to 2004 has been updated.

[2] Net catches from 1996 to 2004 have been updated with data from DFO Catch Finalization Project (2009).

[3] Prior to 1992, catch was not reported as inside or outside. Therefore inside catch for those years represents total tidal sport catch.

Table A12.–Johnstone Strait ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Johnstone Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport[3]			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			30,295			18,065			NA			48,360	0	0
1976	NA			31,855			30,838			NA			62,693	0	0
1977	NA			49,511			26,868			NA			76,379	0	0
1978	NA			55,148			13,052			NA			68,200	0	0
1979	NA			31,291			13,052			NA			44,343	0	0
1980	NA			30,325			11,743			NA			42,068	0	0
1981	NA			28,620			13,035			NA			41,655	0	0
1982	NA			29,454			11,234			NA			40,688	0	0
1983	NA			28,364			14,653			NA			43,017	0	0
1984	NA			18,361			9,260			NA			27,621	0	0
1985	NA			38,073			3,567			NA			41,640	0	0
1986	NA			17,866			3,951			NA			21,817	0	0
1987	NA			13,863			1,780			NA			15,643	0	0
1988	NA			6,292			1,566			NA			7,858	0	0
1989	NA			29,486			1,825			NA			31,311	0	0
1990	NA			18,433			2,298			NA			20,731	0	0
1991	1,287			15,071			1,228			9,311			26,897	0	0
1992	29			9,571			2,721			15,470			27,791	0	0
1993	20			15,530			4,172			12,679			32,401	0	0
1994	0			8,991			2,231			5,433			16,655	0	0
1995	71			970			4			4,296			5,341	0	0
1996	107			472			0			3,057			3,636	0	0

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Table A12.–Page 2 of 2.

	Johnstone Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport[3]			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1997	179			1,018			1,246			4,047			6,490	0	0
1998	138			328			2,129			2,710			5,305	0	0
1999	469			472			273			8,985			10,199	0	0
2000	212			280			85			5,960			6,537	0	0
2001	370			332			453			4,150			5,305	0	0
2002	400			569			129			3,696			4,794	0	0
2003	130			306			719			9,851			11,006	0	0
2004	28			525			316			16,131			17,000	0	0
2005	NA	NA	0	291	1,925	1,596	2	0	0	16,076	9,522	2,937	16,369	11,447	4,533
2006	200	NA	9	244	5,304	4,073	0	612	135	10,532	4,526	1,596	10,976	10,442	5,813
2007	200	NA	9	2	331	304	0	293	68	9,882	5,814	1,798	10,084	6,438	2,179
2008	324	NA	15	48	447	325	0	0	0	4,436	3,985	1,071	4,808	4,432	1,411
2009	344	NA	16	597	14	426	0	0	0	11,501	15,984	3,862	12,442	15,998	4,304
2010	250	NA	12	98	2,908	2,278	2	428	101	10,016	9,092	2,437	10,366	12,428	4,827
2011	268	NA	12	46	2,312	1,710	0	36	7	11,934	5,169	1,816	12,248	7,517	3,546
2012	321	NA	15	37	468	346	0	44	9	7,874	7,899	2,060	8,232	8,411	2,429
2013	258	NA	12	35	241	181	0	0	0	8,260	6,710	1,858	8,553	6,951	2,051
2014	1,637	NA	75	311	3,634	2,840	0	0	0	9,339	6,906	1,970	11,287	10,540	4,885
2015	261	0	12	54	1,162	848	0	0	0	11,931	8,717	2,497	12,246	9,879	3,357
2016	347	0	16	0	15	14	0	0	0	8,734	7,299	2,004	9,081	7,314	2,034

Note: Troll = Area 12; Net = Areas 11–13.

Note: Sport based on July and August creel census in Area 12 and northern half of Area 13.

[1] Troll and net catches from 1996 to 2004 have been updated with data from DFO (2009).

[2] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. The same catch accounting period was applied for years prior to 1998.

[3] Tidal sport creel catches include additional catch estimated using Argue et al. (1977).

Table A13.–Georgia Strait ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Georgia Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975							174,001			398,000			572,001	0	0
1976							200,229			490,000			690,229	0	0
1977							248,082			372,000			620,082	0	0
1978							217,955			500,000			717,955	0	0
1979							255,057			350,000			605,057	0	0
1980							273,077			204,100			477,177	0	0
1981							239,266			197,239			436,505	0	0
1982							179,040			124,390			303,430	0	0
1983							105,133			198,433			303,566	0	0
1984							90,280			369,445			459,725	0	0
1985							55,888			234,838			290,726	0	0
1986							44,043			181,896			225,939	0	0
1987							38,084			121,081			159,165	0	0
1988							20,224			119,117			139,341	0	0
1989							28,444			132,846			161,290	0	0
1990							34,304			111,914			146,218	0	0
1991							32,412			115,523			147,935	0	0
1992							37,250			116,581			153,831	0	0
1993							33,293			127,576			160,869	0	0
1994							12,916			70,839			83,755	0	0
1995							138			62,173			62,311	0	0
1996				8			14			89,589			89,611	0	0

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Year	Georgia Strait														
	First Nations			Net[1]			Troll[1,2]			Tidal Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1997				1			806			56,332			57,139	0	0
1998				11			303			20,923			21,237	0	0
1999				0			219			43,588			43,807	0	0
2000				0			609			32,750			33,359	0	0
2001				3	708	512	311	169	39	31,259			31,573	877	551
2002				16	601	446	459	205	49	52,979			53,454	806	496
2003				18	1,368	999	279	189	43	19,981			20,278	1,557	1,042
2004				0	881	645	389	235	54	13,475			13,864	1,116	699
2005				20	703	485	0	206	42	11,972	10,102	2,766	11,992	11,011	3,293
2006				0	3	3	0	3	1	12,181	4,730	1,749	12,181	4,736	1,752
2007				0	200	144	0	0	0	14,561	25,595	5,919	14,561	25,795	6,063
2008	4,848		223	0	156	112	0	0	0	8,836	8,772	2,294	13,684	8,928	2,629
2009	0	0	0	239	0	171	0	135	0	17,884	21,644	5,390	18,123	21,779	5,561
2010	40		2	54	1,128	863	5	359	85	14,942	13,704	3,662	15,041	15,191	4,613
2011	2,379	17	126	3	113	86	0	177	36	21,651	20,327	5,397	24,033	20,634	5,644
2012	3,096		142	0	0	0	0	0	0	22,457	45,785	10,340	25,553	45,785	10,483
2013	843	0	39	4	188	138	0	0	0	25,036	74,417	16,016	25,883	74,605	16,193
2014	28	1	20	0	44	32	0	0	0	46,251	47,161	12,246	46,279	47,206	12,280
2015	0	0	0	0	13	10	0	17	3	59,460	38,217	11,440	59,460	38,247	11,453
2016	650	0	30	3	136	115	0	42	8	43,498	58,099	14,156	44,151	58,277	14,309

Note: Troll = Areas 13–18; Net = Areas 14–19; Sport = Areas 13–18, 19a.

[1] Troll and net catches, 1996–2004, have been updated with data from DFO (2009).

[2] Since 1998, the catch accounting year for troll fisheries was set from October 1 to September 30. The same catch accounting period was applied for years prior to 1998.

Table A14.–Fraser River ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Fraser River Watershed											
	First Nations[1]			Net[2]			Freshwater Sport[3,4]			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	20,170			66,119			7,740			94,029	0	0
1976	19,189			73,018			6,354			98,561	0	0
1977	23,310			85,222			3,071			111,603	0	0
1978	19,541			50,247			3,627			73,415	0	0
1979	10,217			51,488			4,450			66,155	0	0
1980	10,528			40,061			7			50,596	0	0
1981	8,389			22,447			0			30,836	0	0
1982	29,043			23,792			96			52,931	0	0
1983	11,875			25,580			0			37,455	0	0
1984	17,111			27,929			80			45,120	0	0
1985	8,387			28,894			596			37,877	0	0
1986	12,274			31,401			1,421			45,096	0	0
1987	12,050			12,021			3,561			27,632	0	0
1988	12,063			8,446			3,702			24,211	0	0
1989	4,784			23,443			2,500			30,727	0	0
1990	14,180			15,689			2,982			32,851	0	0
1991	13,950			14,757			3,116			31,823	0	0
1992	10,067			7,363			4,677			22,107	0	0
1993	15,395			13,885			3,430			32,710	0	0
1994	17,892			13,693			3,195			34,780	0	0
1995	17,791			6,451			8,258			32,500	0	0
1996	12,665			12,910			7,635			33,210	0	0
1997	13,453			40,877			5,051			59,381	0	0

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Year	Fraser River Watershed											
	First Nations[1]			Net[2]			Freshwater Sport[3,4]			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1998	14,702			8,292			18,073			41,067	0	0
1999	17,999			4,043			8,509			30,551	0	0
2000	20,839			8,244			12,836			41,919	0	0
2001	18,429			10,052	28	462	25,023			53,504	28	462
2002	21,796			9,732	329	281	24,355			55,883	329	281
2003	28,137			11,204	287	272	19,520			58,861	287	272
2004	31,165			19,224	197	186	18,581			68,970	197	186
2005	19,832	0	879	9,088	97	335	22,688	13,322	2,720	51,608	13,419	3,934
2006	14,793	333	950	7,686	61	213	26,662	550	1,062	49,141	944	2,225
2007	13,714	759	1,333	6,795	44	166	12,945	8,694	1,586	33,454	9,497	3,085
2008	22,417	96	973	4,575	89	276	18,597	13,810	3,366	45,589	13,995	4,615
2009	27,288	105	1,203	7,848	146	330	17,485	15,845	3,611	52,621	16,096	5,143
2010	15,432	298	992	13,953	67	705	14,324	13,512	3,583	43,709	13,877	5,279
2011	33,118	96	1,614	17,989	1,073	1,843	20,349	9,022	3,136	71,456	10,191	6,594
2012	36,521	104	1,778	2,899	1,059	1,135	11,396	7,333	2,194	50,816	8,496	5,108
2013	17,092	113	893	3,124	6,537	6,328	11,506	10,211	2,754	31,722	16,861	9,975
2014	22,434	62	1,091	17,149	9,200	9,492	13,105	13,004	3,401	52,688	22,266	13,984
2015	24,693	73	1,205	7,051	1,928	2,148	18,487	8,703	2,947	50,231	10,704	6,300
2016	10,291	338	793	2,292	373	458	7,512	5,218	1,520	20,095	5,929	2,771

[1] First Nations Chinook salmon catch includes food, social, and ceremonial from the mainstem and tributaries. Economic opportunity included in commercial net.

[2] Fraser River net includes commercial Area E Gillnet, test fisheries, First Nations economic opportunities, and scientific licenses.

[3] Freshwater sport catch includes Fraser mainstem and tributary Chinook salmon catch (adults only).

[4] Updated 1975 to 1980 sport catch from Fraser et al. 1982.

Table A15.–Canada: Strait of Juan de Fuca ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Canada: Strait of Juan de Fuca											
	First Nations			Net[1]			Tidal Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	NA			9,799			NA			9,799	0	0
1976	NA			13,004			NA			13,004	0	0
1977	NA			25,344			NA			25,344	0	0
1978	NA			9,725			NA			9,725	0	0
1979	NA			8,665			NA			8,665	0	0
1980	NA			3,438			37,900			41,338	0	0
1981	NA			9,982			29,832			39,814	0	0
1982	NA			7,072			30,646			37,718	0	0
1983	NA			328			30,228			30,556	0	0
1984	NA			6,237			24,353			30,590	0	0
1985	NA			17,164			27,843			45,007	0	0
1986	NA			17,727			34,387			52,114	0	0
1987	NA			6,782			24,878			31,660	0	0
1988	NA			4,473			31,233			35,706	0	0
1989	NA			21,238			32,539			53,777	0	0
1990	42			7,405			30,127			37,574	0	0
1991	250			8,893			19,017			28,160	0	0
1992	302			10,023			21,090			31,415	0	0
1993	317			2,287			13,967			16,571	0	0
1994	600			8,931			14,372			23,903	0	0
1995	751			631			14,405			15,787	0	0
1996	20			655			19,012			19,687	0	0
1997	42			657			17,080			17,779	0	0
1998	1,500			495			9,709			11,704	0	0
1999	52			771			14,808			15,631	0	0

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Year	Canada: Strait of Juan de Fuca											
	First Nations			Net[1]			Tidal Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2000	272			199			10,973			11,444	0	0
2001	135			439			23,463			24,037	0	0
2002	NA			345			24,084			24,429	0	0
2003	NA			292			26,630			26,922	0	0
2004	NA			187			40,877			41,064	0	0
2005	NA			153	0	110	30,480	11,857	4,380	30,633	11,857	4,490
2006	NA			155	801	606	26,437	5,079	2,799	26,592	5,880	3,405
2007	NA			138	690	534	26,549	11,832	4,104	26,687	12,522	4,638
2008	NA			172	573	442	22,263	6,540	2,792	22,435	7,113	3,234
2009	NA			385	0	277	25,587	44,169	10,246	25,972	44,169	10,523
2010	NA			206	1,239	920	15,612	4,868	2,012	15,818	6,107	2,932
2011	NA			278	1,522	1,166	21,075	12,878	3,927	21,353	14,400	5,093
2012	NA			284	1,124	853	22,154	10,603	3,564	22,438	11,727	4,417
2013	NA			273	1,411	1,099	32,363	24,550	6,947	32,636	25,961	8,046
2014	NA			137	495	475	20,290	15,771	4,428	20,427	16,266	4,903
2015	NA			17	2,610	1,885	41,292	25,941	7,830	41,309	28,551	9,715
2016	NA			0	1,256	924	22,965	23,863	6,166	22,965	25,119	7,090

Note: NA = Not available.

Note: Net = Area 20; Sport = Areas 19b and 20.

[1] Net catches from 1996 to 2004 have been updated with data from DFO (2009).

Table A16.–Washington: Strait of Juan de Fuca ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington: Strait of Juan de Fuca											
	Troll			**Net**			**Sport**			**Total**		
Year	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**
1975	5,762	NA	144	8,048	NA	644	81,681	NA	11,844	95,491	NA	12,632
1976	10,486	NA	262	6,072	NA	486	75,308	NA	10,920	91,866	NA	11,668
1977	8,958	NA	224	16,794	NA	1,344	53,238	NA	7,720	78,990	NA	9,287
1978	10,002	NA	250	12,676	NA	1,014	62,299	NA	9,033	84,977	NA	10,297
1979	7,575	NA	189	13,479	NA	1,078	67,094	NA	9,729	88,148	NA	10,996
1980	10,688	NA	267	12,753	NA	1,020	56,415	NA	8,180	79,856	NA	9,468
1981	15,644	NA	391	21,607	NA	1,729	51,352	NA	7,446	88,603	NA	9,566
1982	18,952	NA	474	25,490	NA	2,039	29,842	NA	4,327	74,284	NA	6,840
1983	18,468	NA	462	16,761	NA	1,341	58,060	NA	8,419	93,289	NA	10,221
1984	15,805	NA	395	12,377	NA	990	48,003	NA	6,960	76,185	NA	8,346
1985	12,759	NA	319	12,965	NA	1,037	44,267	NA	6,419	69,991	NA	7,775
1986	30,346	NA	759	17,228	NA	1,378	69,000	NA	10,005	116,574	NA	12,142
1987	45,005	NA	1,125	11,439	NA	915	53,000	NA	7,685	109,444	NA	9,725
1988	49,755	NA	1,244	11,692	NA	935	39,000	NA	5,655	100,447	NA	7,834
1989	65,992	NA	1,650	10,306	NA	824	52,000	NA	7,540	128,298	NA	10,014
1990	46,940	NA	1,174	5,213	NA	417	50,903	NA	7,381	103,056	NA	8,971
1991	37,040	NA	926	3,750	NA	300	39,667	NA	5,752	80,457	NA	6,978
1992	31,370	NA	784	1011	NA	81	38,438	NA	5,574	70,819	NA	6,439
1993	10,422	NA	261	1,457	NA	117	32,434	NA	4,703	44,313	NA	5,080
1994	3,419	NA	85	5,895	NA	472	1,661	NA	241	10,975	NA	798
1995	6,406	NA	160	4,770	NA	382	6,349	NA	921	17,525	NA	1,462
1996	9,910	NA	248	604	NA	48	4,825	NA	700	15,339	NA	996
1997	847	NA	21	492	NA	39	12,238	NA	1,775	13,577	NA	1,835

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Table A16.–Page 2 of 2.

	Washington: Strait of Juan de Fuca											
	Troll			**Net**			**Sport**			**Total**		
Year	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**
1998	707	NA	18	266	NA	21	2,159	NA	313	3,132	NA	352
1999	658	NA	16	589	NA	47	1,990	NA	289	3,237	NA	352
2000	347	NA	9	800	NA	64	1,670	NA	242	2,817	NA	315
2001	1,974	NA	49	931	NA	74	4,819	NA	699	7,724	NA	823
2002	1,783	NA	45	1,074	NA	86	2,028	NA	294	4,885	NA	425
2003	436	NA	11	908	NA	73	5,290	28201	8325	6,634	28,201	8,408
2004	20,756	NA	519	593	NA	47	4,519	22275	6625	25,868	22,275	7,191
2005	5,350	NA	134	175	NA	14	2,700	10189	3122	8,225	10,189	3,270
2006	1,056	NA	26	994	NA	80	5,695	14823	4798	7,745	14,823	4,904
2007	4,346	NA	109	107	NA	9	6,967	23133	7210	11,420	23,133	7,327
2008	1,816	NA	45	4,579	NA	366	4,844	13359	4283	11,239	13,359	4,694
2009	3,359	NA	84	99	NA	8	11,167	46047	13960	14,625	46,047	14,052
2010	2,216	NA	55	2,220	NA	178	11,508	38036	11862	15,944	38,036	12,095
2011	3,818	NA	95	359	NA	29	9,504	20601	6899	13,681	20,601	7,023
2012	2,350	NA	59	1,544	NA	124	13,854	28,233	9,575	17,748	28,233	9,758
2013	3,295	NA	82	449	NA	36	14,900	59,364	18,070	18,644	59,364	18,188
2014	4,512	NA	113	1,314	NA	105	11,059	26,877	8,807	16,885	26,877	9,025
2015[1]	4,876	NA	122	831	NA	66	11,810	32,687	10,473	17,517	32,687	10,661
2016[1]	578	NA	14	248	NA	20	12,590	34,845	11,164	13,416	34,845	11,198

Note: Troll: Areas 5, 6, and 6C; Area 4B from January 1 – April 30 and October 1 – December 31; Net = Areas 4B, 5, 6, and 6C; Sport = Areas 5 and 6, 4B Neah Bay "add-on" fishery.

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A17.–Washington: San Juan ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington: San Juan											
	Troll			Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	3	NA	0	90,100	NA	7,208	31,988	NA	4,638	122,091	NA	11,846
1976	0	NA	0	66,832	NA	5,347	34,505	NA	5,003	101,337	NA	10,350
1977	9	NA	0	82,452	NA	6,596	14,049	NA	2,037	96,510	NA	8,633
1978	0	NA	0	86,113	NA	6,889	15,083	NA	2,187	101,196	NA	9,076
1979	0	NA	0	51,210	NA	4,097	17,367	NA	2,518	68,577	NA	6,615
1980	0	NA	0	62,899	NA	5,032	12,231	NA	1,773	75,130	NA	6,805
1981	0	NA	0	47,611	NA	3,809	9,727	NA	1,410	57,338	NA	5,219
1982	0	NA	0	35,778	NA	2,862	6,953	NA	1,008	42,731	NA	3,870
1983	0	NA	0	27,792	NA	2,223	15,166	NA	2,199	42,958	NA	4,422
1984	0	NA	0	33,175	NA	2,654	25,759	NA	3,735	58,934	NA	6,389
1985	0	NA	0	33,232	NA	2,659	12,610	NA	1,828	45,842	NA	4,487
1986	0	NA	0	21,307	NA	1,705	15,000	NA	2,175	36,307	NA	3,880
1987	48	NA	1	28,692	NA	2,295	14,000	NA	2,030	42,740	NA	4,327
1988	118	NA	3	29,749	NA	2,380	9,000	NA	1,305	38,867	NA	3,688
1989	592	NA	15	15,690	NA	1,255	9,000	NA	1,305	25,282	NA	2,575
1990	443	NA	11	8,540	NA	683	7,370	NA	1,069	16,353	NA	1,763
1991	41	NA	1	11,304	NA	904	5,115	NA	742	16,460	NA	1,647
1992	99	NA	2	13,893	NA	1,111	6,788	NA	984	20,780	NA	2,098
1993	0	NA	0	13,951	NA	1,116	6,916	NA	1,003	20,867	NA	2,119
1994	0	NA	0	13,877	NA	1,110	5,795	NA	840	19,672	NA	1,950
1995	0	NA	0	5,332	NA	427	7,863	NA	1,140	13,195	NA	1,567
1996	0	NA	0	3,934	NA	315	12,674	NA	1,838	16,608	NA	2,152
1997	11	NA	0	29,593	NA	2,367	9,155	NA	1,327	38,759	NA	3,695

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Year	Washington: San Juan											
	Troll			Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1998	7	NA	0	3,798	NA	304	3,069	NA	445	6,874	NA	749
1999	0	NA	0	3	NA	0	3,421	NA	496	3,424	NA	496
2000	7	NA	0	841	NA	67	4,447	NA	645	5,295	NA	712
2001	0	NA	0	970	NA	78	6,522	NA	946	7,492	NA	1,023
2002	0	NA	0	1,931	NA	154	4,827	NA	700	6,758	NA	854
2003	0	NA	0	4,827	NA	386	3,008	1,646	877	7,835	1,646	1,264
2004	0	NA	0	5,133	NA	411	1,971	1,190	605	7,104	1,190	1,015
2005	0	NA	0	4,358	491	741	2,703	1,544	806	7,061	2,035	1,547
2006	0	NA	0	5,241	439	770	4,168	1,278	947	9,409	1,717	1,717
2007	0	NA	0	2,584	476	588	4,955	3,933	1,773	7,539	4,409	2,360
2008	0	NA	0	48	76	65	5,829	2,673	1,562	5,877	2,749	1,626
2009	0	NA	0	1,014	2,012	1,691	4,077	5,375	2,032	5,091	7,387	3,722
2010	0	NA	0	6,129	4,972	4,468	3,157	2,402	1,102	9,286	7,374	5,570
2011	0	NA	0	5,630	11,893	9,965	6,193	6,603	2,668	11,823	18,496	12,632
2012	0	NA	0	420	218	208	5,764	5,688	2,360	6,184	5,906	2,568
2013	0	NA	0	3,908	12,160	10,041	9,502	7,328	3,342	13,410	19,488	13,382
2014	0	NA	0	6,826	5,711	5,115	9,216	9,075	3,768	16,042	14,786	8,883
2015	0	NA	0	4,773	7,928	6,724	8,593	11,925	4,442	13,366	19,853	11,166
2016[1]	0	NA	0	22	0	2	9,104	12,633	4,706	9,126	12,633	4,708

Note: Troll = Areas 6, 6A, 7, and 7A; Net = Areas 6, 6A, 7 and 7A.

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A18.–Washington: Other Puget Sound ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Washington: Other Puget Sound								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	131,982	NA	10,559	173,086	NA	25,097	305,068	NA	35,656
1976	141,281	NA	11,302	151,246	NA	21,931	292,527	NA	33,233
1977	145,470	NA	11,638	97,761	NA	14,175	243,231	NA	25,813
1978	150,298	NA	12,024	116,979	NA	16,962	267,277	NA	28,986
1979	128,073	NA	10,246	156,402	NA	22,678	284,475	NA	32,924
1980	171,516	NA	13,721	142,799	NA	20,706	314,315	NA	34,427
1981	145,152	NA	11,612	106,048	NA	15,377	251,200	NA	26,989
1982	149,274	NA	11,942	85,703	NA	12,427	234,977	NA	24,369
1983	134,492	NA	10,759	123,752	NA	17,944	258,244	NA	28,703
1984	180,248	NA	14,420	102,740	NA	14,897	282,988	NA	29,317
1985	184,907	NA	14,793	92,603	NA	13,427	277,510	NA	28,220
1986	153,000	NA	12,240	88,000	NA	12,760	241,000	NA	25,000
1987	127,000	NA	10,160	59,000	NA	8,555	186,000	NA	18,715
1988	133,000	NA	10,640	63,000	NA	9,135	196,000	NA	19,775
1989	156,000	NA	12,480	75,000	NA	10,875	231,000	NA	23,355
1990	179,593	NA	14,367	71,000	NA	10,295	250,593	NA	24,662
1991	89,495	NA	7,160	48,859	NA	7,085	138,354	NA	14,244
1992	63,460	NA	5,077	51,656	NA	7,490	115,116	NA	12,567
1993	54,968	NA	4,397	41,034	NA	5,950	96,002	NA	10,347
1994	63,577	NA	5,086	44,181	NA	6,406	107,758	NA	11,492
1995	63,593	NA	5,087	61,509	NA	8,919	125,102	NA	14,006
1996	61,658	NA	4,933	58,538	NA	8,488	120,196	NA	13,421
1997	47,522	NA	3,802	43,961	NA	6,374	91,483	NA	10,176

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Year	Washington: Other Puget Sound								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1998	50,915	NA	4,073	30,016	NA	4,352	80,931	NA	8,426
1999	91,947	NA	7,356	34,116	NA	4,947	126,063	NA	12,303
2000	79,494	NA	6,360	29,328	NA	4,253	108,822	NA	10,612
2001	123,266	NA	9,861	40,170	NA	5,825	163,436	NA	15,686
2002	108,566	NA	8,685	35,031	NA	5,079	143,597	NA	13,765
2003	86,206	NA	6,896	32,210	93,129	29,629	118,416	93,129	36,526
2004	69,211	NA	5,537	22,650	64,586	20,593	91,861	64,586	26,130
2005	82,629	557	7,156	30,760	50,748	18,061	108,638	51,306	25,217
2006	109,557	NA	8,765	40,082	152,129	46,582	149,639	152,129	55,347
2007	118,628	NA	9,490	57,468	149,778	48,473	176,096	149,778	57,964
2008	101,322	NA	8,106	36,969	86,174	28,455	138,291	86,174	36,561
2009	68,764	NA	5,501	33,332	75,820	25,153	102,096	75,820	30,654
2010	80,599	NA	6,448	32,817	43,512	16,420	113,416	43,512	22,868
2011	100,353	NA	8,028	29,829	78,760	25,433	130,182	78,760	33,461
2012	117,259	NA	9,381	45,279	113,847	37,076	162,538	113,847	46,457
2013	105,104	NA	8,408	36,276	56,634	20,438	141,380	56,634	28,846
2014	50,767	NA	4,061	23,903	44,942	15,510	74,670	44,942	19,572
2015[1]	58,162	NA	4,653	20,050	99,807	29,656	78,212	99,807	34,308
2016[1]	79,251	NA	6,340	26,743	50,282	17,353	105,994	50,282	23,693

Note: Net = Areas 6B, 6D, 7B, 7C, and 7E, Areas 8–13 (including all subareas), and Areas 74C–83F; Sport = Areas 8–13 and all Puget Sound rivers.

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A19.–Washington: Inside Coastal ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington: Inside Coastal								
	Net			**Sport**			**Total**		
Year	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**
1975	34,859	NA	697	1,716	NA	118	36,575	NA	816
1976	51,995	NA	1,040	2,219	NA	153	54,214	NA	1,193
1977	72,467	NA	1,449	2,043	NA	141	74,510	NA	1,590
1978	32,662	NA	653	3,399	NA	235	36,061	NA	888
1979	36,501	NA	730	2,199	NA	152	38,700	NA	882
1980	47,681	NA	954	1,476	NA	102	49,157	NA	1,055
1981	36,880	NA	738	786	NA	54	37,666	NA	792
1982	33,271	NA	665	1,114	NA	77	34,385	NA	742
1983	16,210	NA	324	1,452	NA	100	17,662	NA	424
1984	16,239	NA	325	1,319	NA	91	17,558	NA	416
1985	25,162	NA	503	1,955	NA	135	27,117	NA	638
1986	29,000	NA	580	3,000	NA	207	32,000	NA	787
1987	51,000	NA	1,020	3,000	NA	207	54,000	NA	1,227
1988	74,000	NA	1,480	7,000	NA	483	81,000	NA	1,963
1989	85,000	NA	1,700	6,000	NA	414	91,000	NA	2,114
1990	57,770	NA	1,155	5,000	NA	345	62,770	NA	1,500
1991	54,397	NA	1,088	6,070	NA	419	60,467	NA	1,507
1992	64,223	NA	1,284	6,577	NA	454	70,800	NA	1,738
1993	59,285	NA	1,186	9,180	NA	633	68,465	NA	1,819
1994	46,059	NA	921	7,454	NA	514	53,513	NA	1,436
1995	46,490	NA	930	9,881	NA	682	56,371	NA	1,612
1996	55,408	NA	1,108	12,059	NA	832	67,467	NA	1,940
1997	28,269	NA	565	6,619	NA	457	34,888	NA	1,022
1998	20,266	NA	405	6,569	NA	453	26,835	NA	859
1999	11,400	NA	228	3,165	NA	218	14,565	NA	446
2000	15,660	NA	313	3,179	NA	219	18,839	NA	533
2001	19,480	NA	390	8,645	NA	597	28,125	NA	986
2002	23,372	NA	467	6,038	NA	417	29,410	NA	884
2003	18,443	NA	369	6,075	NA	419	24,518	NA	788
2004	21,965	NA	439	12,088	NA	834	34,053	NA	1,273
2005	20,668	NA	413	7,051	NA	487	27,719	NA	900
2006	27,414	NA	548	8,030	NA	554	35,444	NA	1,102
2007	12,353	NA	247	5,066	NA	350	17,419	NA	597

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Year	Washington: Inside Coastal								
	Net			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2008	15,028	NA	301	3,808	NA	263	18,836	NA	563
2009	18,728	NA	375	6,629	NA	457	25,357	NA	832
2010	12,794	NA	256	6,831	NA	471	19,625	NA	727
2011	39,034	NA	781	13,340	NA	920	52,374	NA	1,701
2012	29,232	NA	585	9,646	NA	666	38,878	NA	1,250
2013	31,111	NA	622	10,188	NA	703	41,299	NA	1,325
2014	39,514	NA	790	9,740	NA	672	49,254	NA	1,462
2015[1]	32,760	NA	655	22,612	NA	1,560	55,372	NA	2,215
2016[1]	14,135	NA	283	14,180	NA	978	28,315	NA	1,261

Note: Net = Areas 2A–2M and Areas 72B–73H; Sport = All coastal rivers, Area 2.1, and Area 2.2 (when Area 2 is closed)

Note: NA = Not available; for fisheries without estimate of releases, IM is dropoff/dropout only.

[1] Current year not available; values are average of previous three years.

Table A20.–Washington/Oregon North of Cape Falcon ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Washington/Oregon North of Cape Falcon											
	Troll			Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	268,971	NA	6,724	1,212	NA	24	265,785	NA	7,176	535,968	NA	13,925
1976	371,239	NA	9,281	203	NA	4	215,319	NA	5,814	586,761	NA	15,099
1977	244,491	NA	6,112	4	NA	0	197,563	NA	5,334	442,058	NA	11,447
1978	150,673	NA	3,767	4	NA	0	104,306	NA	2,816	254,983	NA	6,583
1979	133,035	NA	3,326	3	NA	0	84,977	NA	2,294	218,015	NA	5,620
1980	125,709	NA	3,143	1,215	NA	24	59,099	NA	1,596	186,023	NA	4,763
1981	109,519	NA	2,738	209	NA	4	96,151	NA	2,596	205,879	NA	5,338
1982	154,720	NA	3,868	267	NA	5	114,952	NA	3,104	269,939	NA	6,977
1983	63,584	NA	1,590	62	NA	1	51,789	NA	1,398	115,435	NA	2,989
1984	15,392	NA	385	0	NA	0	6,980	NA	188	22,372	NA	573
1985	55,408	NA	1,385	493	NA	10	30,189	NA	815	86,090	NA	2,210
1986	52,000	NA	1,300	0	NA	0	23,000	NA	621	75,000	NA	1,921
1987	81,000	NA	2,025	4,000	NA	80	44,000	NA	1,188	129,000	NA	3,293
1988	108,000	NA	2,700	3,000	NA	60	19,000	NA	513	130,000	NA	3,273
1989	74,600	NA	1,865	1,000	NA	20	20,900	NA	564	96,500	NA	2,449
1990	65,800	NA	1,645	0	0	0	32,900	NA	888	98,700	NA	2,533
1991	51,600	NA	1,290	0	0	0	13,300	NA	359	64,900	NA	1,649
1992	69,000	NA	1,725	0	0	0	18,900	NA	510	87,900	NA	2,235
1993	55,900	NA	1,398	0	0	0	13,600	NA	367	69,500	NA	1,765
1994	4,500	NA	113	0	0	0	0	NA	–	4,500	NA	113
1995	9,500	NA	238	0	0	0	600	NA	16	10,100	NA	254
1996	12,300	NA	308	0	0	0	200	NA	5	12,500	NA	313
1997	20,500	NA	513	0	0	0	4,100	NA	111	24,600	NA	623

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	Washington/Oregon North of Cape Falcon											
	Troll			Net			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1998	20,615	12,496	3,577	0	0	0	2,292	2,676	463	22,907	15,172	4,040
1999	44,923	27,231	7,795	0	0	0	10,821	6,365	1,247	55,744	33,596	9,042
2000	20,152	12,215	3,497	0	0	0	9,242	8,392	1,508	29,394	20,607	5,005
2001	54,163	35,824	10,131	0	0	0	25,592	34,378	5,848	79,755	70,201	15,979
2002	106,462	60,250	17,423	0	0	0	60,575	68,561	11,920	167,037	128,810	29,342
2003	101,758	54,313	15,851	0	0	0	36,513	49,063	8,345	138,271	103,375	24,196
2004	88,225	83,219	22,594	0	0	0	27,090	69,900	11,216	115,315	153,119	33,811
2005	87,126	36,282	11,067	0	0	0	40,004	21,736	4,341	127,130	58,018	15,408
2006	57,313	52,482	14,291	0	0	0	11,176	9,630	1,746	68,489	62,112	16,037
2007	38,742	36,050	9,801	0	0	0	9,535	21,631	3,502	48,277	57,681	13,303
2008	35,100	NA	878	0	0	0	15,452	6,782	1,434	50,552	6,782	2,312
2009	25,410	NA	635	0	0	0	13,331	34,341	5,511	38,741	34,341	6,146
2010	88,565	NA	2,214	0	0	0	38,686	34,652	6,242	127,251	34,652	8,456
2011	61,433	NA	1,536	0	0	0	30,826	49,623	8,276	92,259	49,623	9,812
2012	99,792	NA	2,495	0	0	0	35,428	38,283	6,699	135,220	38,283	9,194
2013	91,915	NA	2,298	0	0	0	30,837	42,634	7,228	122,752	42,634	9,526
2014	116,489	NA	2,912	0	0	0	42,327	34,056	6,251	158,816	34,056	9,163
2015	125,384	NA	3,135	0	0	0	42,179	18,983	3,986	167,563	18,983	7,121
2016[1]	42,234	NA	1,056	0	0	0	17,948	21,133	3,654	60,182	21,133	4,710

Note: Troll = Oregon Area 2; Washington Areas 1, 2, 3 and 4: Area 4B from May 1 through September 30 (during Pacific Fishery Management Council management); Net = Washington Areas 1, 2, 3, 4, 4A; Sport = Oregon Area 2; Washington Areas 1, 1.1, 1.2, 2, 3, 4 and 2.2 (when Area 2 is open).

Note: For fisheries without estimate of releases, IM is dropoff/dropout only.

Note: NA = Not available.

[1] Current year not available; values are average of previous three years.

Table A21.–Columbia River ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

Year	Washington and Oregon Columbia River[1]											
	Nontreaty Net			**Treaty Indian Net**			**Sport**			**Total**		
	LC	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**
1975[1,2]	323,000	0	9,690				34,870	NA	2,406	357,870	NA	12,096
1976[1,2]	288,400	0	8,652				42,527	NA	2,934	330,927	NA	11,586
1977[1,2]	255,600	0	7,668				58,838	NA	4,060	314,438	NA	11,728
1978[1,2]	189,100	0	5,673				56,582	NA	3,904	245,682	NA	9,577
1979[1,2]	169,691	0	5,091	7,865	0	236	38,700	NA	2,670	216,256	NA	7,997
1980	113,569	0	3,407	35,604	0	1,068	15,011	NA	1,036	164,184	NA	5,511
1981	35,881	0	1,076	54,190	0	1,626	21,151	NA	1,459	111,222	NA	4,162
1982	94,289	0	2,829	67,224	0	2,017	31,236	NA	2,155	192,749	NA	7,001
1983	32,877	0	986	34,036	0	1,021	23,206	NA	1,601	90,119	NA	3,609
1984	73,481	0	2,204	61,828	0	1,855	43,760	NA	3,019	179,069	NA	7,079
1985	74,982	0	2,249	80,436	0	2,413	45,444	NA	3,136	200,862	NA	7,798
1986	168,038	0	5,041	118,578	0	3,557	57,993	NA	4,002	344,609	NA	12,600
1987	340,931	0	10,228	154,169	0	4,625	105,835	NA	7,303	600,935	NA	22,156
1988	341,114	0	10,233	165,677	0	4,970	97,638	NA	6,737	604,429	NA	21,941
1989	146,739	0	4,402	145,859	0	4,376	88,088	NA	6,078	380,686	NA	14,856
1990	63,602	0	1,908	95,317	0	2,860	79,467	NA	5,483	238,386	NA	10,251
1991	53,935	0	1,618	60,931	0	1,828	79,260	NA	5,469	194,126	NA	8,915
1992	24,063	0	722	39,616	0	1,188	56,417	NA	3,893	120,096	NA	5,803
1993	19,929	0	598	51,516	0	1,545	64,995	NA	4,485	136,440	NA	6,628
1994	2,773	0	83	36,633	0	1,099	29,634	NA	2,045	69,040	NA	3,227
1995	777	0	23	43,010	0	1,290	36,394	NA	2,511	80,181	NA	3,825
1996	17,774	0	533	70,956	0	2,129	31,672	NA	2,185	120,402	NA	4,847
1997	11,268	0	338	76,473	0	2,294	45,984	NA	3,173	133,725	NA	5,805
1998	6,409	0	192	48,410	0	1,452	34,342	NA	2,370	89,161	NA	4,014
1999	10,090	NA	303	81,164	0	2,435	45,094	NA	3,111	136,348	NA	5,849

–continued–

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	Washington and Oregon Columbia River[1]											
	Nontreaty Net			**Treaty Indian Net**			**Sport**			**Total**		
Year	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**	**LC**	**Rel.**	**IM**
2000	21,318	NA	640	70,848	0	2,125	49,631	NA	3,425	141,797	NA	6,190
2001	40,932	3,348	2,165	201,673	0	6,050	141,848	16,453	12,989	384,454	19,801	21,205
2002	69,963	6,699	3,974	196,619	0	5,899	150,735	21,625	14,588	417,317	28,323	24,461
2003	74,619	2,395	2,909	159,067	0	4,772	149,157	15,960	13,276	382,843	18,355	20,957
2004	76,003	5,061	3,813	168,220	0	5,047	148,966	14,743	13,056	393,189	19,803	21,916
2005	45,208	1,685	1,828	138,197	0	4,146	91,019	32,233	12,429	274,423	33,918	18,403
2006	44,061	2,332	1,975	115,966	0	3,479	72,495	4,786	5,943	232,522	7,118	11,397
2007	25,726	2,996	1,611	64,804	0	1,944	56,359	5,466	4,938	146,889	8,462	8,493
2008	51,541	1,630	2,003	148,641	0	4,459	88,738	11,365	8,180	288,920	12,995	14,642
2009	54,485	921	1,892	121,761	0	3,653	90,154	10,681	8,108	266,400	11,602	13,653
2010	87,149	1,684	3,086	218,909	0	6,567	166,247	11,150	13,486	472,305	12,834	23,140
2011	91,188	1,765	3,230	183,203	0	5,496	150,061	11,901	12,349	424,451	13,666	21,075
2012	72,491	1,260	2,528	166,440	0	4,993	152,726	19,152	13,734	391,657	20,412	21,255
2013	119,330	1,037	3,870	259,213	0	7,776	163,672	33,604	17,090	542,215	34,641	28,736
2014	131,945	2,182	4,569	324,783	0	9,743	184,855	44,911	20,651	641,583	47,093	34,963
2015	124,980	3,738	4,796	336,708	0	10,101	253,224	34,685	24,061	714,912	38,423	38,958
2016[3]	84,698	2,101	3,129	181,030	0	5,431	146,551	21,351	13,647	412,279	23,453	22,207

Note: NA = Not available.

1 The historical time series of catches in this year's report has changed from previous year's report. Catches after 1980 have been broken out into nontreaty net and treaty Indian due to the inability to separate Treaty Indian commercial versus noncommercial. Non-treaty net includes catches by Wanapum and Colville tribes. Sport and total catches from 1975 to 1980 are consistent with previous year's reports.

2 The Treaty Indian Net catch estimates for 1975–1979 are not available, but are believed to be of the magnitude seen after 1979; the catch for 1979 represents spring-run catches and does not include catch estimates for summer and fall stocks. Sport and total catch estimates from 1975-1979 are consistent with previous year's reports, but the total is underestimated because of the missing estimates.

3 Preliminary.

Table A22.–Oregon ISBM Chinook salmon landed catch (LC), releases (Rel.), and incidental mortality (IM).

	Oregon Coastal Inside								
	Troll			Sport			Total		
Year	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
1975	300	NA	5	19,000	NA	1,311	19,300	NA	1,316
1976	1,000	NA	17	21,000	NA	1,449	22,000	NA	1,466
1977	3,000	NA	51	34,000	NA	2,346	37,000	NA	2,397
1978	1,000	NA	17	37,000	NA	2,553	38,000	NA	2,570
1979	800	NA	14	31,000	NA	2,139	31,800	NA	2,153
1980	300	NA	5	22,000	NA	1,518	22,300	NA	1,523
1981	300	NA	5	28,000	NA	1,932	28,300	NA	1,937
1982	500	NA	9	23,000	NA	1,587	23,500	NA	1,596
1983	700	NA	12	19,000	NA	1,311	19,700	NA	1,323
1984	1,088	NA	17	27,000	NA	1,863	28,088	NA	1,880
1985	1,700	NA	27	25,000	NA	1,725	26,700	NA	1,752
1986	1,900	NA	30	33,000	NA	2,277	34,900	NA	2,307
1987	3,600	NA	58	46,000	NA	3,174	49,600	NA	3,232
1988	4,800	NA	77	49,000	NA	3,381	53,800	NA	3,458
1989	4,500	NA	72	45,000	NA	3,105	49,500	NA	3,177
1990	0	NA	0	38,000	NA	2,622	38,000	NA	2,622
1991	0	NA	0	44,500	NA	3,071	44,500	NA	3,071
1992	384	NA	6	39,000	NA	2,691	39,384	NA	2,697
1993	649	NA	10	52,000	NA	3,588	52,649	NA	3,598
1994	371	NA	6	33,590	NA	2,318	33,961	NA	2,324
1995	206	NA	3	48,366	NA	3,337	48,572	NA	3,341
1996	989	NA	16	56,202	NA	3,878	57,191	NA	3,894
1997	513	NA	8	37,659	NA	2,598	38,172	NA	2,607
1998	858	NA	14	37,990	NA	2,621	38,848	NA	2,635
1999	1,233	NA	20	30,735	NA	2,121	31,968	NA	2,140
2000	1,860	NA	30	33,262	NA	2,295	35,122	NA	2,325
2001	1,184	NA	19	54,988	NA	3,794	56,172	NA	3,813
2002	1,633	NA	26	61,085	NA	4,215	62,718	NA	4,241
2003	1,459	NA	23	67,939	NA	4,688	69,398	NA	4,711
2004	2,258	NA	36	71,726	NA	4,949	73,984	NA	4,985
2005	1,956	NA	31	27,866	NA	1,923	29,822	NA	1,954

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Table A22.–Page 2 of 2.

Year	Oregon Coastal Inside								
	Troll			Sport			Total		
	LC	Rel.	IM	LC	Rel.	IM	LC	Rel.	IM
2006	1,884	NA	30	39,357	NA	2,716	41,241	NA	2,746
2007	1,018	NA	16	25,684	NA	1,772	26,702	NA	1,788
2008	208	NA	3	10,780	NA	744	10,988	NA	747
2009	293	NA	5	6,537	NA	451	6,830	NA	456
2010	1,315	NA	21	23,366	NA	1,612	24,681	NA	1,633
2011	1,954	NA	31	33,089	NA	2,283	35,043	NA	2,314
2012	636	NA	16	26,272	NA	1,813	26,908	NA	1,829
2013	1,188	NA	30	46,247	NA	3,191	47,435	NA	3,221
2014	847	NA	21	46,919	NA	3,237	47,766	NA	3,259
2015	1,164	NA	29	69,790	NA	4,816	70,954	NA	4,845
2016[1]	182	NA	5	49,652	NA	3,426	49,834	NA	3,431

Note: Troll = late season off Elk River mouth, Sport = estuary and inland.

Note: NA = Not available.

[1] Preliminary value based on average harvest rates.

Table A23.–Summary of landed catches (LC) of PSC AABM and ISBM fisheries.

Year[1]	Southeast Alaska AABM [2,3]	Southeast Alaska Non-Treaty	US ISBM[4]	US Total	NBC AABM[2]	WCVI AABM[2]	Canada ISBM[4,5]	Canada Total	PSC Total
1975	317,707		1,114,493	1,432,200	228,121	546,214	949,027	1,723,362	3,155,562
1976	258,762		1,148,705	1,407,467	190,267	665,010	1,078,748	1,934,025	3,341,492
1977	302,178		972,299	1,274,477	131,005	545,742	1,070,562	1,747,309	3,021,786
1978	418,411		782,494	1,200,905	146,179	568,705	1,078,144	1,793,028	2,993,933
1979	382,641		729,715	1,112,356	147,576	477,222	991,275	1,616,073	2,728,429
1980	343,970		890,965	1,234,935	157,398	486,303	834,970	1,478,671	2,713,606
1981	289,034		780,208	1,069,242	153,249	423,266	753,274	1,329,789	2,399,031
1982	314,686		872,565	1,187,251	173,687	538,510	675,858	1,388,055	2,575,306
1983	311,658		637,407	949,065	162,927	395,636	643,778	1,202,341	2,151,406
1984	290,077		665,194	955,271	185,305	471,294	797,975	1,454,574	2,409,845
1985	268,293	6,246	734,112	1,002,405	166,445	345,937	560,860	1,073,242	2,075,647
1986	271,262	11,091	880,390	1,151,652	176,868	350,227	508,465	1,035,560	2,187,212
1987	265,323	17,095	1,171,719	1,437,042	180,101	378,931	403,645	962,677	2,399,719
1988	256,787	22,525	1,204,543	1,461,330	159,428	408,668	379,609	947,705	2,409,035
1989	269,522	21,510	1,002,266	1,271,788	228,331	203,751	487,390	919,472	2,191,260
1990	320,996	45,873	807,858	1,128,854	170,936	297,858	470,242	939,036	2,067,890
1991	297,986	61,476	599,264	897,250	209,065	203,035	559,065	971,165	1,868,415
1992	221,980	36,811	524,895	746,875	163,698	358,664	457,801	980,163	1,727,038
1993	271,193	32,910	488,236	759,429	186,983	300,345	460,543	947,871	1,707,300
1994	235,165	29,185	299,419	534,584	193,554	160,352	303,987	657,893	1,192,477
1995	176,939	58,800	351,046	527,985	79,388	95,410	205,325	380,123	908,108
1996	154,997	81,262	409,703	564,700	678	10,233	216,603	227,514	792,214
1997	286,696	56,306	375,204	661,900	110,999	59,088	261,366	431,453	1,093,353

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Year[1]	Southeast Alaska AABM [2,3]	Southeast Alaska Non-Treaty	US ISBM[4]	US Total[6]	NBC AABM[2]	WCVI AABM[2]	Canada ISBM[4,5]	Canada Total	PSC Total[6]
1998	243,152	27,441	268,688	511,840	143,202	9,317	195,646	348,165	860,005
1999	198,842	52,178	371,349	570,191	84,324	38,540	222,566	345,430	915,621
2000	186,493	76,797	342,086	528,579	32,048	88,617	168,545	289,210	817,789
2001	186,919	78,815	721,069	907,988	43,334	120,304	208,425	372,063	1,280,051
2002	357,133	69,401	822,691	1,179,824	149,831	157,886	238,976	546,693	1,726,517
2003	380,152	59,284	739,836	1,119,988	194,797	173,561	251,759	620,117	1,740,106
2004	417,019	82,249	733,195	1,150,213	241,508	215,252	295,628	752,388	1,902,601
2005	388,637	104,480	579,170	967,806	243,606	199,479	293,046	736,131	1,703,937
2006	360,066	75,439	538,765	898,831	215,985	145,485	265,787	627,257	1,526,088
2007	328,197	76,442	428,930	757,126	144,235	140,614	233,979	518,828	1,275,954
2008	172,841	71,389	519,001	691,842	95,647	145,726	184,055	425,428	1,117,269
2009	228,033	65,640	455,019	683,053	109,470	124,617	209,160	443,247	1,126,300
2010	230,750	53,949	775,549	1,006,300	136,613	139,047	166,004	441,664	1,447,964
2011	290,669	66,319	755,326	1,045,996	122,660	204,232	283,031	609,923	1,655,919
2012	242,549	52,473	771,545	1,014,094	120,307	134,468	191,724	446,499	1,460,593
2013	191,428	65,825	918,103	1,109,531	115,914	113,598	176,215	405,727	1,515,258
2014	435,166	57,336	993,653	1,428,819	216,901	188,374	234,514	639,789	2,068,608
2015	337,794	67,537	1,060,081	1,397,875	158,903	116,737	281,532	557,172	1,955,047
2016	353,704	35,768	679,146	1,032,849	190,181	99,650	181,960	471,791	1,504,640

[1] All LC from 1975 to 1984 were taken prior to implementation of the PST.

[2] LC in AABM fisheries from 1985 to 1994 were taken under fixed ceiling management per the 1985 PST Agreement. Catches from 1995 to 1998 were between agreements. LC from 1999 to 2012 was taken commensurate with abundance-based management per the 1999 PST Agreement (1999–2008) and the 2009 PST Agreement (2009–present).

[3] Southeast Alaska nontreaty catches are primarily Alaska hatchery add-ons, but include terminal exclusions in some years from terminal catches from the Situk, Taku and Stikine rivers.

[4] US and Canadian ISBM fisheries had a pass-through obligation from 1985 to 1994 under the 1985 PST Agreement and have operated with ISBM index obligations since 1999, under the 1999 and 2009 Agreements

[5] Catches in the Canada ISBM column include catches in the Strait of Georgia (troll and sport), Central British Columbia troll, and Northern British Columbia net and mainland sport fisheries from 1985 to 1994 when these were AABM fisheries operating under fixed ceiling management provisions of the 1985 PST Agreement.

[6] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

Table A24.–Estimated incidental mortality (LIM and SIM in nominal fish) associated with Chinook salmon catches in US and Canadian AABM and ISBM fisheries.[1]

Year	Southeast Alaska AABM[2]	Southeast Alaska Non-Treaty	US ISBM	US Total[5]	NBC AABM[2]	WCVI AABM[2]	Can ISBM[3]	Can Total	PSC Total[4, 5]
2005	45,913	10,585	66,699	112,612	20,563	14,814	46,248	81,625	194,237
2006	47,975	8,625	93,251	141,225	14,761	11,557	33,914	60,232	201,458
2007	71,486	22,234	91,832	163,318	13,923	12,403	40,397	66,723	230,041
2008	38,134	8,633	61,146	99,280	6,335	12,312	23,848	42,495	141,776
2009	44,973	11,042	69,515	114,489	9,705	15,817	37,925	63,447	177,936
2010	38,428	5,517	74,489	112,918	12,739	16,017	24,885	53,641	166,559
2011	41,595	9,887	88,019	129,614	18,619	17,005	33,030	68,654	198,268
2012	45,885	19,637	92,310	138,196	11,556	16,390	32,933	60,880	199,075
2013	59,411	42,813	103,224	162,635	19,926	16,606	48,565	85,097	247,732
2014	50,944	18,530	86,327	137,272	17,276	17,088	49,233	83,597	220,869
2015	49,148	21,647	109,274	158,422	21,673	10,971	43,651	76,296	234,718
2016	54,306	6,265	71,208	125,514	14,136	9,394	39,339	62,869	188,383

Note: LIM = Legal Incident Mortality, SIM = Sublegal Incident Mortality.

[1] The IM estimates presented in this table are not equivalent to LC on a one-to-one fish basis because of the inclusion of SIMs, which are smaller, less mature fish.

[2] IM estimates (LIM + SIM) are available for AABM fisheries from 1985 to present (CTC 2011).

[3] IM estimates for the ISBM fisheries prior to 2005 were not available for many subcomponents of these fisheries at this printing, but will be included in next year's CTC catch and escapement report.

[4] The PST total needs to be viewed with caution per footnote 1.

[5] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

Table A25.–Estimated total mortality (LC and IM) associated with Chinook salmon catches in US and Canadian AABM and ISBM fisheries.

Year	Southeast Alaska AABM	Southeast Alaska Non-Treaty	US ISBM	US Total[2]	NBC AABM	WCVI AABM	Can ISBM	Can Total	PSC Total[1,2]
2005	434,550	115,065	649,717	1,084,267	264,169	214,293	339,294	817,756	1,902,023
2006	408,040	84,065	637,740	1,045,780	230,746	157,042	299,701	687,489	1,733,269
2007	399,683	98,676	526,173	925,856	158,158	153,017	274,376	585,551	1,511,407
2008	210,975	80,022	585,849	796,824	101,982	158,038	207,903	467,923	1,264,747
2009	273,007	76,683	528,655	801,662	119,175	140,434	247,085	506,694	1,308,356
2010	269,179	59,467	856,997	1,126,176	149,352	155,064	190,889	495,305	1,621,481
2011	332,264	76,206	847,833	1,180,097	141,279	221,237	316,061	678,577	1,858,674
2012	288,434	72,109	871,443	1,159,878	131,863	150,858	224,657	507,379	1,667,256
2013	250,838	108,637	1,030,359	1,281,197	135,840	130,204	224,780	490,824	1,772,021
2014	486,110	75,866	1,091,343	1,577,453	234,177	205,462	283,747	723,386	2,300,839
2015	384,177	89,957	1,227,170	1,611,347	180,576	127,708	325,183	633,468	2,244,815
2016	408,009	42,034	750,354	1,158,363	204,317	109,044	221,299	534,660	1,693,023

[1] Total mortality estimates prior to 2005 will be included in next year's CTC catch and escapement report when estimates from the ISBM fisheries are available.

[2] Does not include SEAK AABM fishery nontreaty catch from hatchery add-on and terminal exclusion.

APPENDIX B. ESCAPEMENTS AND TERMINAL RUNS OF PACIFIC SALMON COMMISSION CHINOOK TECHNICAL COMMITTEE CHINOOK SALMON ESCAPEMENT INDICATOR STOCKS, 1975–2014

Appendix **Page**

B1. Southeast Alaska estimates of escapement and CVs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *190*

B2. Transboundary River estimates of escapement and CVs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *192*

B3. Northern British Columbia escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *194*

B4. Southern British Columbia escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *196*

B5. West Coast Vancouver Island 6-stream index escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *197*

B6. Fraser River escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *198*

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B9. Columbia upriver spring and upriver summer escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks. *204*

B10. Columbia River fall Chinook escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks. *206*

B11. Oregon Coastal escapements as estimated via traditional habitat expansion methods and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. *208*

B12. Oregon Coastal escapements and terminal runs (t. run) as estimated by MR calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. Estimates presented in boldface represent estimates generated from direct MR studies. *209*

Table B1.–Southeast Alaska estimates of escapement and CVs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Southeast Alaska Chinook Stocks							
	Situk River		Chilkat R.		Unuk River		Chickamin R.	
Year	Esc	CV[1]	Esc	CV	Esc	CV	Esc[2]	CV
1975							1,758	0.15
1976	1,421						746	0.15
1977	1,732				4,706	0.12	1,724	0.15
1978	808				5,344	0.12	1,463	0.15
1979	1,284				2,783	0.12	1,135	0.15
1980	905				4,909	0.12	2,114	0.15
1981	702				3,532	0.12	1,824	0.15
1982	434				6,528	0.12	2,712	0.15
1983	592				5,436	0.12	2,845	0.15
1984	1,726				8,876	0.12	5,235	0.15
1985	1,521				5,721	0.12	4,541	0.15
1986	2,067				10,273	0.12	8,289	0.15
1987	1,379				9,533	0.12	4,631	0.15
1988	868	0.02			8,437	0.12	3,734	0.15
1989	637				5,552	0.12	4,437	0.15
1990	628				2,856	0.12	2,679	0.15
1991	889	0.01	5,882	0.17	3,165	0.12	2,313	0.15
1992	1,595	0.01	5,277	0.18	4,223	0.12	1,644	0.15
1993	952	0.03	4,463	0.19	5,160	0.12	1,848	0.15
1994	1,271	0.03	6,792	0.16	3,435	0.12	1,843	0.15
1995	4,330	0.04	3,768	0.21	3,730	0.12	2,309	0.31
1996	1,800	0.10	4,902	0.15	5,639	0.12	1,587	0.13
1997	1,878	0.11	8,089	0.15	2,970	0.09	1,292	0.15
1998	924	0.14	3,656	0.15	4,132	0.1	1,857	0.15
1999	1,461	0.10	2,258	0.18	3,914	0.13	2,337	0.15
2000	1,785	0.08	2,029	0.16	5,872	0.11	3,805	0.15
2001	656	0.03	4,514	0.16	10,541	0.11	5,177	0.19
2002	1,000	0.01	4,034	0.11	6,988	0.12	5,007	0.15
2003	2,117	0.03	5,631	0.12	5,546	0.08	4,579	0.13
2004	698	0.03	3,406	0.13	3,963	0.08	4,268	0.21
2005	595	0.01	3,361	0.16	4,742	0.08	4,257	0.14
2006	295		3,003	0.13	5,645	0.08	6,318	0.15
2007	677		1,435	0.16	5,668	0.08	4,242	0.15
2008	413		2,881	0.16	3,104	0.12	5,277	0.15
2009	902		4,406	0.13	3,157	0.11	2,902	0.15
2010	167		1,797	0.13	3,835	0.16	5,491	0.15
2011	240		2,674	0.10	3,195	0.21	4,052	0.15

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	Southeast Alaska Chinook Stocks							
	Situk River		Chilkat R.		Unuk River		Chickamin R.	
Year	**Esc**	**CV**[1]	**Esc**	**CV**	**Esc**	**CV**	**Esc.**[2]	**CV**
2012	322		1,723	0.15	956	0.16	2,109	0.15
2013	912		1,719	0.19	1,135	0.16	2,223	0.15
2014	475		1,529	0.20	1,691	0.12	3,097	0.15
2015	174		2,456	0.11	2,623	0.12	2,760	0.15
2016[3]	329		1,386	0.14	1,463	0.12	964	0.15
Lower	500		1,750		1,800		2,150	
Upper	1,000		3,500		3,800		4,300	

[1] Escapement is enumerated using a weir on the Situk River and CVs are only applicable for years having estimates of sport.

[2] Escapement is enumerated using index counts in the Chickamin River and these counts are not expanded to an estimate of total escapement; therefore, CVs are not applicable.

[3] Preliminary data.

Table B2.–Transboundary River estimates of escapement and CVs of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Transboundary River Stocks					
	Alsek R.		**Taku R.**		**Stikine R.**	
Year	**Esc**	**CV**	**Esc**	**CV**	**Esc**	**CV**
1975			12,920	0.38	7,571	0.21
1976	5,282	0.35	24,582	0.38	5,723	0.16
1977	12,706	0.35	29,496	0.38	11,445	0.16
1978	12,034	0.35	17,124	0.38	6,835	0.21
1979	17,354	0.35	21,617	0.38	12,610	0.21
1980	10,862	0.35	39,239	0.38	30,573	0.16
1981	8,502	0.35	49,559	0.38	36,057	0.21
1982	9,475	0.35	23,847	0.38	40,488	0.16
1983	10,344	0.35	9,795	0.38	6,424	0.21
1984	7,238	0.35	20,778	0.38	13,995	0.21
1985	6,127	0.35	35,916	0.38	16,037	0.15
1986	11,069	0.35	38,110	0.38	14,889	0.15
1987	11,141	0.35	28,935	0.38	24,632	0.15
1988	8,717	0.35	44,524	0.38	37,554	0.15
1989	10,119	0.35	40,329	0.14	24,282	0.15
1990	8,609	0.35	52,143	0.18	22,619	0.15
1991	11,625	0.35	51,645	0.38	23,206	0.15
1992	5,773	0.35	55,889	0.38	34,129	0.15
1993	13,855	0.35	66,125	0.38	58,962	0.15
1994	15,863	0.35	48,368	0.38	33,094	0.15
1995	24,772	0.35	33,805	0.15	16,784	0.15
1996	15,922	0.35	79,019	0.12	28,949	0.10
1997	12,494	0.35	114,938	0.16	26,996	0.11
1998	6,833	0.33	31,039	0.38	25,968	0.15
1999	14,597	0.24	16,786	0.19	19,947	0.16
2000	7,905	0.25	34,997	0.15	27,531	0.12
2001	6,705	0.41	46,554	0.15	63,523	0.09
2002	5,569	0.61	55,044	0.2	50,875	0.12
2003	5,904	0.44	36,435	0.18	46,824	0.13
2004	7,083	0.52	75,032	0.14	48,900	0.08
2005	4,478	0.35	38,725	0.12	40,501	0.07
2006	2,323	0.35	42,296	0.13	24,405	0.28
2007	2,827	0.35	14,854	0.22	14,560	0.15
2008	1,885	0.35	27,383	0.09	18,352	0.16
2009	6,239	0.35	22,801	0.12	11,086	0.23
2010	9,518	0.35	29,302	0.09	15,180	0.13
2011	6,668	0.35	27,523	0.15	14,569	0.11
2012	2,660	0.35	19,429	0.12	22,671	0.17

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Year	Transboundary River Stocks					
	Alsek R.		Taku R.		Stikine R.	
	Esc	CV	Esc	CV	Esc	CV
2013	5,044	0.35	18,002	0.38	16,735	0.22
2014	3,357	0.51	23,532	0.09	24,360	0.15
2015	5,697	0.36	28,850	0.14	21,343	0.16
2016	2,574	0.35	12,381	0.12	10,343	0.19
Lower	3,500		19,000		14,000	
Upper	5,300		36,000		28,000	

Table B3.–Northern British Columbia escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year		Northern British Columbia											
	Area 1 Yakoun R. Esc	Area 3[1] Nass R.			Area 4 Skeena R.			Area 8 Dean R. index	Area 8[2] Atnarko R.		Wild[4]	Area 9 Rivers Inlet	Area 10 Smith Inlet[5]
		Above GW[1]	Esc	t. run	Total Esc	GSI[3] esc	GSI[3] SD		Total Esc	CV			
1975	1,500		14,895	17,874	20,319				3,600			3,280	960
1976	700		13,819	16,583	13,078				11,700			1,640	1,000
1977	800	13,688	14,288	18,410	29,018				10,800			2,225	1,050
1978	600	15,485	16,885	21,807	22,661			3,500	13,500			2,800	2,100
1979	400	11,253	12,783	16,229	18,488			4,000	4,050			2,150	500
1980	600	13,476	14,855	18,744	23,429			2,000	6,480			2,325	1,200
1981	750	12,625	13,925	17,606	24,523			3,500	4,050			3,175	1,020
1982	1,400	7,959	10,359	13,287	17,092				7,200			2,250	1,500
1983	600	13,252	16,301	20,516	23,562			500	7,740			3,320	1,050
1984	300	20,967	24,967	31,408	37,598	51,348	14,818	4,500	13,788			1,400	770
1985	1,500	17,782	19,694	24,768	53,599	30,875	5,648	4,000	24,804			3,371	230
1986	500	36,523	38,123	47,967	59,968	28,398	6,204	3,300	19,170			7,623	532
1987	2,000	19,540	20,986	26,568	59,120	150,874	27,774	1,144	12,983			5,239	1,050
1988	2,000	15,345	16,715	21,094	68,705	91,496	13,217	1,300	13,500			4,429	1,050
1989	2,800	28,133	29,175	36,594	57,202	72,422	10,457	2,300	19,800			3,265	225
1990	2,000	24,051	26,551	33,384	55,976	64,188	10,638	2,000	16,710	0.143	11,630	4,039	510
1991	1,900	6,907	8,259	13,136	52,753	41,940	7,364	2,400	13,906	0.132	8,952	6,635	500
1992	2,000	16,808	17,408	25,405	63,392	103,365	25,532	3,000	32,862	0.128	22,015	7,500	500
1993	1,000	24,814	26,508	36,678	66,977	119,780	22,066	700	35,430	0.126	20,961	10,000	500
1994	2,000	21,169	25,689	32,864	48,712	78,228	14,149	1,300	28,178	0.112	12,257	3,500	700
1995	1,500	7,844	8,776	16,187	34,390	62,272	16,627	1,100	23,420	0.179	8,150	3,196	400
1996	3,000	21,842	22,712	30,889	73,684	155,637	32,769	2,000	20,767	0.106	5,962	3,000	250
1997	2,500	18,702	20,584	27,658	42,539	57,368	12,437	1,400	11,251	0.088	4,013	4,980	100
1998	3,000	23,213	25,361	34,922	46,744	80,677	16,199	3,000	13,470	0.078	6,094	5,367	1,100
1999	3,200	11,544	13,118	22,310	43,775	53,418	8,204	1,800	16,549	0.141	7,199	2,739	500
2000	3,600	18,912	20,565	31,159	51,804	95,563	13,496	1,200	17,352	0.064	9,964	6,700	500

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Year		Northern British Columbia											
	Area 1 Yakoun R. Esc	Area 3[1] Nass R.			Area 4 Skeena R.			Area 8 Dean R. index	Area 8[2] Atnarko R.			Area 9 Rivers Inlet	Area 10 Smith Inlet[5]
		Above GW[1]	Esc	t. run	Total Esc	GSI[3] esc	GSI[3] SD		Total Esc	CV	Wild[4]		
2001	3,500	29,687	31,915	44,595	81,504	145,120	18,738	3,795	***21,635***	***0.034***	***16,743***	5,062	300
2002	3,000	13,773	15,382	21,528	44,771	89,235	11,984	3,731	***11,511***	***0.084***	***8,550***	5,031	
2003	4,000	26,940	28,330	36,503	56,758	114,346	16,234	3,700	***12,619***	***0.055***	***10,136***	1,900	
2004	4,500	15,912	18,185	25,137	44,243	142,141	19,631	3,500	11,825	0.089	8,230	3,950	
2005	5,000	14,363	16,595	24,067	29,067	77,531	9,783	2,200	11,677	0.110	7,619	5,585	
2006	NA	24,725	27,743	37,098	33,094	84,199	15,599	3,700	19,288	0.156	9,565	3,930	
2007	NA	21,459	25,524	34,221	33,352	85,179	17,559	2,300	8,229	0.061	5,799	5,000	
2008	NA	17,862	20,198	26,202	32,963	71,446	13,043	1,100	7,288	0.073	5,517	5,792	
2009	NA	28,710	30,334	36,865	38,297	80,900	16,297	1,400	***10,926***	***0.047***	***6,331***	4,580	
2010	NA	19,341	20,821	26,052	43,331	101,486	19,344	1,600	***10,497***	***0.059***	***5,683***	4,225	
2011	NA	9,639	10,415	15,092	37,073	53,682	12,239	750	***8,645***	***0.071***	***6,061***	4,400	
2012	NA	8,309	9,815	15,086	34,024	33,473	5,746	NA	***7,425***	***0.060***	***2,542***	4,142	
2013	NA	8,011	9,306	13,525	26,699	39,179	4,903	NA	***22,690***	***0.047***	***9,860***	4,672	
2014	NA	11,623	13,108	19,789	28,496	44,200	6,876	NA	***19,180***	***0.046***	***11,935***	4,190	
2015	NA	16,433	19,465	28,557	41,658	53,770	6,700	2,470	***44,594***	***0.120***	***13,640***	5,328	
2016	NA	9,037	10,191	15,977	34,153	31,297	4,632	NA	***24,234***	***0.047***	***9,737***	5,200	

Note: NA = Not available.

[1] GW refers to Gitwinksihlkw, the location of the lower fish wheels on the Nass River used to capture Chinook salmon for the MR estimate.

[2] Estimates prior to 1990 are visual counts, 1990–2000 and 2004–2008 are based on time series calibration, 2001–2003 and 2009–2016 are maximum likelihood estimates based on MR estimates.

[3] Genetic Stock Identification.

[4] Large wild Atnarko Chinook salmon.

[5] The Docee River was dropped as an escapement indicator beginning in 2002 due to an inability to obtain reliable escapement estimates.

Table B4.–Southern British Columbia escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Lower Strait of Georgia		Upper Strait of Georgia[1,2]					
	Nanaimo	**Cowichan**	**Nimpkish**	**Klinaklini**	**Kakweiken**	**Kingcome**	**Wakeman**	**Esc. index**
1975	5,475		1,100	16,560	200	1,500	1,500	20,860
1976	4,340		3,500	14,569	650	1,500	2,000	22,219
1977	6,530		750	21,078	130	750	750	23,458
1978	6,495		1,300	13,848	350	1,000	1,000	17,498
1979	2,741	7,945	500	7,955	60	50	233	8,798
1980	2,982	5,837	300	4,883	500	32	35	5,750
1981	225	5,782	700	8,619	200	20	25	9,564
1982	1,152	5,034	700	12,887	196	450	750	14,983
1983	1,840	4,742	1,500	10,536	160	359	309	12,864
1984	3,178	5,278	3,000	5,776	88	197	169	9,230
1985	914	3,675	3,000	9,327	500	150	300	13,277
1986	958	2,147	700	22,697	344	774	100	24,616
1987	757	2,519	3,000	27,069	411	1,500	1,000	32,980
1988	1,079	6,878	1,500	6,800	103	200	500	9,103
1989	1,552	5,535	3,850	40,002	607	500	800	45,759
1990	1,397	5,626	1,200	11,650	177	300	300	13,626
1991	935	7,408	1,400	22,784	140	526	300	25,150
1992	1,127	10,250	3,400	13,643	50	316	152	17,561
1993	1,405	7,030	300	3,406	53	193	223	4,175
1994	1,072	6,407	300	3,427	30	108	79	3,944
1995	2,300	16,449	300	4,755	157	426	54	5,692
1996	1,870	14,595	399	3,857	50	124	108	4,538
1997	1,772	9,973	350	3,800	39	450	125	4,764
1998	1,800	5,858	450	9,980	6	450	250	11,136
1999	2,371	6,110	640	11,068	146	70	281	12,205
2000	1,446	6,638	350	17,202	30	228	31	17,841
2001	2,448	5,015	365	9,355	129	527	116	10,492
2002	1,747	4,115	570	12,529	33	301	73	13,506
2003	1,672	3,356	385	13,365	164	122	21	14,057
2004	550	2,721	969	6,310	96	744	32	8,150
2005	1,036	2,467	576	3,980	60	95	28	4,739
2006	2,135	1,775	500	14,228	216	316	145	15,405
2007	2,267	2,175	514	5,791	88	75	90	6,558
2008	2,671	2,015	532	4,915	75	35	35	5,592
2009	1,470	785	929	10,134	154	64	19	11,300
2010	2,201	2,419	543	7,119	108	55	26	7,851
2011	3,937	2,786	720	4,829	5	6	20	5,580
2012	1,063	2,668	2,630	18,174	276	4	20	21,103
2013	593	4,406	2,589	18,041	274	26	24	20,954
2014	1,689	4,185	2,520	17,899	272	18	17	20,725
2015	3,146	5,984	1,659	15,254	231	494	424	18,062
2016	1,982	7,787	2,008	16,220	246	525	451	19,450
Goal		6,500						

[1] Upper Strait of Georgia Strait escapement updated with time series for 5-stream index.

[2] The escapement time series for the UGS stock includes estimates based on consistent methods within each river, and escapements to rivers missing escapement data for some years (i.e., no surveys) were estimated using the procedures described by English et al. (2007).

Table B5.–West Coast Vancouver Island 6-stream index escapements of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	WCVI[1]						
	Marble	**Burman**	**Tahsis**	**Artlish**	**Kaouk**	**Tahsish**	**Esc. index**
1975	400	200	75	25	75	25	800
1976	400	400	200	25	25	25	1,075
1977	950	500	150	60	75	100	1,835
1978	1,500	1,000	100	50	50	50	2,750
1979	750	650	348	40	60	200	2,048
1980	5,000	345	373	100	100	200	6,118
1981	3,000	300	150	500	100	1,000	5,050
1982	5,000	70	125	100	100	1,000	6,395
1983	1,000	475	50	400	300	500	2,725
1984	600	700	12	650	400	1,500	3,862
1985	1,250	500	50	400	300	1,200	3,700
1986	1,100	400	60	100	100	1,000	2,760
1987	1,750	100	20	100	100	500	2,570
1988	3,275	500	125			400	4,300
1989	4,181	780	500	40	30	450	5,981
1990	1,973	1,100	300	50	10	200	3,633
1991	710	2,767	1,515	20	20	120	5,152
1992	800	2,198	1,463	10	80	600	5,151
1993	2,000	1,750	578	10	20	250	4,608
1994	650	2,330	380	100	150	250	3,860
1995	1,626	594	525	99	266	600	3,710
1996	3,971	724	771	53	219	288	6,026
1997	2,638	2,354	722	402	558	523	7,197
1998	5,297	3,205	587	300	824	1,430	11,643
1999	4,185	2,399	1,731	539	453	879	10,186
2000	2,572	212	1,220	75	105	391	4,575
2001	1,450	107	389	139	409	237	2,731
2002	2,485	440	758	41	251	308	4,283
2003	1,749	768	762	379	358	440	4,456
2004	3,658	2,636	905	454	301	495	8,449
2005	2,354	642	182	199	488	121	3,986
2006	3,071	516	141	228	536	76	4,568
2007	2,764	353	133	162	193	234	3,839
2008	2,683	515	281	200	264	380	4,323
2009	3,440	1,800	780	214	550	80	6,864
2010	3,560	3,028	380	110	185	355	7,618
2011	3,910	2,020	220	100	300	260	6,810
2012	2,364	1,003	163	141	223	138	4,032
2013	2,081	8,285	545	399	240	350	11,900
2014	1,185	3,002	653	91	192	653	5,776
2015	6,516	6,292	310	1,113	331	768	15,330
2016	2,406	10,756	369	166	370	615	14,682

[1] The escapement methodology changed for the WCVI streams in 1995, and the earlier estimates have not been calibrated.

Table B6.–Fraser River escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Fraser River								
	Fraser Spring Age 1.2	Fraser Spring Age 1.3	Fraser Summer Age 0.3	Fraser Summer Age 1.3	Fraser Spring/ Summer	Harrison		Lower Shuswap[1]	
	Esc	Esc	Esc	Esc	t. run	Esc	CV	Esc	CV
1975	8,260	6,668	41,090	16,273	119,081			31,531	0.342
1976	5,545	7,875	6,339	11,335	98,691			3,776	0.418
1977	4,458	9,776	26,397	15,050	132,553			16,124	0.345
1978	5,159	13,150	24,230	15,992	109,119			17,804	0.343
1979	3,437	12,959	25,492	8,399	101,252			17,056	0.344
1980	7,385	14,563	10,792	11,377	71,504			6,281	0.383
1981	3,693	10,091	16,660	11,416	62,668			8,879	0.365
1982	6,487	11,698	8,100	12,475	85,140			3,289	0.43
1983	3,238	22,158	9,209	14,383	72,526			5,396	0.146
1984	7,259	27,182	15,418	12,935	95,681	120,835		7,582	0.08
1985	11,000	38,476	20,087	15,432	121,941	174,776		10,539	0.075
1986	11,418	46,536	31,557	28,095	144,617	162,594		20,828	0.341
1987	6,036	44,513	29,870	21,273	128,699	79,036		17,056	0.344
1988	4,807	35,533	40,726	28,623	129,587	35,114		24,669	0.34
1989	6,901	27,380	32,503	14,017	106,843	74,683		18,933	0.342
1990	4,000	37,512	35,439	26,747	135,124	177,373		22,741	0.34
1991	4,393	25,085	33,882	19,012	116,555	90,636		17,056	0.344
1992	6,928	27,441	43,250	21,955	130,249	130,409		23,317	0.34
1993	9,062	28,997	17,717	18,383	110,237	118,997		9,762	0.361
1994	12,149	47,972	37,517	17,449	145,303	98,342		28,864	0.341
1995	13,775	40,565	28,276	23,636	134,478	28,616		17,056	0.344
1996	22,002	29,863	67,508	35,311	185,559	37,392		34,520	0.343
1997	12,690	32,654	59,422	34,508	202,795	70,514	0.091	22,933	0.34
1998	3,144	24,763	86,355	31,151	169,333	200,258		34,050	0.341
1999	9,430	17,551	75,475	18,734	140,939	104,415	0.102	46,105	0.349
2000	10,674	20,586	53,145	24,654	155,209	77,754		27,800	0.04
2001	11,990	24,862	92,170	25,134	177,008	108,502		35,744	0.026
2002	16,106	35,458	124,949	29,447	181,357	83,011	0.082	54,219	0.017
2003	19,130	42,697	88,485	45,249	180,710	246,986	0.083	39,317	0.344
2004	14,297	28,062	65,041	32,665	135,298	139,126		16,963	0.045
2005	4,040	19,800	93,726	19,686	132,807	88,589	0.063	17,893	0.031
2006	7,646	20,383	179,792	20,714	198,973	60,421	0.135	59,085	0.024
2007	1,392	10,554	87,187	10,701	109,073	76,483	0.068	15,926	0.027
2008	6,348	14,947	106,587	16,786	188,355	41,603	0.073	14,922	0.037
2009	887	23,807	86,308	21,150	174,392	70,142	0.064	25,278	0.018
2010	6,994	15,236	175,657	19,292	231,620	103,558	0.056	71,354	0.021
2011	3,430	10,681	126,679	15,946	157,349	123,647	0.052	18,895	0.029
2012	8,283	10,948	47,695	9,538	75,976	44,467	0.086	4,091	0.03
2013	4,301	15,560	119,609	10,997	163,397	42,953	0.07	28,797	0.043
2014	11,941	33,223	84,308	23,846	147,993	44,686	0.087	43,952	0.094

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	Fraser River								
	Fraser Spring Age 1.2	**Fraser Spring Age 1.3**	**Fraser Summer Age 0.3**	**Fraser Summer Age 1.3**	**Fraser Spring/ Summer**	**Harrison**		**Lower Shuswap**[1]	
Year	**Esc**	**Esc**	**Esc**	**Esc**	**t. run**	**Esc**	**CV**	**Esc**	**CV**
2015	5,555	22,598	178,247	29,391	281,935	101,516	0.07	39,440	0.021
2016	3,627	13,166	93,175	9,269	139,164	41,327	0.11	6,438	0.06
Goal Lower						75,100			
Goal Upper						98,500			

[1] Escapement was estimated by MR methods from 1983 to 1985, 2000 to 2002, and 2004 to 2012. All other years are calibrated values that have been estimated using a relationship between MR and peak methods.

Table B7.–Puget Sound escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

Year	Puget Sound (includes hatchery strays in natural escapement unless noted otherwise)																	
	Nooksack Spring			Skagit River Spring		Skagit River Summer/Fall		Stillaguamish River			Snohomish River			Lake Washington		Green River		
	MR esc[1]	Tot Esc[2]	NOR Esc[3]	Esc	t. run	Esc	t. run[4]	MR esc[1]	Esc	t. run[4]	MR esc[1]	Esc	t. run	Esc	t. run	MR esc[1]	Esc	t. run
1975				627	627	11,320	30,299		1,198	1,801		3,953	5,993	918	1,004		3,394	6,838
1976				633	633	14,120	28,589		2,140	4,241		4,659	9,740	582	937		3,140	8,246
1977				520	520	9,218	21,502		1,475	2,847		5,542	10,760	944	889		3,804	5,936
1978				932	932	13,075	24,285		1,232	2,159		7,905	13,747	1,245	1,353		3,304	4,766
1979				818	818	13,306	24,350		1,042	2,531		5,726	14,010	1,739	1,578		9,704	11,689
1980				1,408	1,408	20,058	31,250		821	2,818		6,526	18,683	1,903	1,683		7,743	11,248
1981				1,045	1,045	8,283	21,817		630	3,014		3,330	10,466	970	924		3,606	5,532
1982				753	753	9,910	24,259		773	3,229		4,498	9,820	1,189	1,384		1,840	4,271
1983				554	554	8,723	15,758		387	1,089		4,537	11,853	1,646	2,515		3,679	14,376
1984		520		696	696	12,628	15,616		374	920		3,484	9,554	1,610	4,211		3,353	5,890
1985		703		2,634	2,634	16,002	26,230		1,409	2,717		4,730	9,455	1,255	2,627		2,908	7,914
1986		396		1,922	1,922	17,908	22,906		1,277	2,499		4,534	7,322	1,846	2,863		4,792	6,114
1987		429		1,745	1,745	9,409	13,387		1,321	1,982		4,689	6,951	2,652	4,835		10,338	12,283
1988		689		1,743	1,743	11,468	15,262		717	1,245		4,513	7,529	1,015	2,829		7,994	9,667
1989		909		1,400	1,809	6,684	13,270		784	1,664		3,173	5,823	1,234	1,544		11,512	15,244
1990		152		1,511	1,546	16,521	18,950		842	1,867		4,722	6,913	974	1,098		7,035	15,483
1991		473		1,236	1,273	5,824	8,604		1,536	2,969		2,800	3,980	864	1,115		10,548	15,451
1992		601		986	1,010	7,348	9,021		639	1,279		2,708	3,269	999	1,212		5,267	10,165
1993		684		782	812	5,801	7,097		719	1,259		4,019	4,524	307	324		2,476	5,507
1994		163		470	496	5,549	5,912		773	1,323		3,406	3,715	1,068	926		4,078	8,368
1995		520		855	887	6,877	9,239		775	1,495		3,356	3,871	1,202	966		7,939	9,935
1996		738		1,051	1,078	10,613	10,828		1,244	2,276		4,851	5,352	457	362		6,026	8,664
1997		797		1,041	1,064	4,872	6,092		1,156	17,298		4,078	4,259	385	302		7,101	7,778
1998		527	37	1,086	1,091	14,609	14,965		1,544	2,434		6,306	6,658	869	711		5,963	7,777
1999		1,111	117	471	476	4,924	5,229		1,098	2,264		4,791	4,964	992	791		7,135	8,376
2000		1,615	313	1,021	1,025	16,930	17,265		1,645	3,065		6,095	6,613	361	393	10,526	4,473	6,880
2001		2,629	473	1,856	1,866	13,793	14,046		1,349	2,051		8,166	8,709	1,434	1,555	21,402	6,473	9,721
2002		4,366	415	1,076	1,092	19,591	19,911		1,588	2,219		7,223	7,444	941	663	14,857	7,564	11,539
2003		3,448	279	909	987	9,777	10,106		988	1,320		5,447	5,810	1,010	826		5,864	7,871
2004		1,891	373	1,622	1,622	23,553	24,107		1,506	1,974		10,602	11,051	1,371	794		7,947	13,498
2005		2,279	284	1,305	1,305	20,803	23,405		1,036	1,493		4,480	4,974	1,043	788		2,523	2,987
2006		1,716	442	1,896	1,919	20,768	22,539		1,254	1,543		8,188	8,681	1,597	1,433		5,790	8,604
2007		1,786	407	613	613	11,281	13,027		607	866		3,982	4,208	2,309	3,342		4,301	7,205
2008	2,714	1,714	497	1,472	1,472	11,664	14,995	1,711	1,671	1,861		8,373	8,506	1,681	2,917		5,971	10,290

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Table B7.–Page 2 of 2.

Year	Puget Sound (includes hatchery strays in natural escapement unless noted otherwise)																	
	Nooksack Spring			Skagit River Spring		Skagit River Summer/Fall		Stillaguamish River			Snohomish River			Lake Washington		Green River		
	MR esc[1]	Tot Esc[2]	NOR Esc[3]	Esc	t. run	Esc	t. run[4]	MR esc[1]	Esc	t. run[4]	MR esc[1]	Esc	t. run	Esc	t. run	MR esc[1]	Esc	t. run
2009	2,889	2,360	372	983	983	6,955	12,460	1,239	1,001	1,218		2,309	2,370	793	951		688	1,067
2010	4,303	2,596	277	1,361	1,537	8,037	9,060	837	783	1,014		4,299	4,435	729	734	4,541	2,092	2,112
2011	2,620	1,348	264	825	1,015	5,536	9,181	1,637	1,017	1,264	10,399	1,880	1,972	890	1,034	3,382	993	1,464
2012	2,176	1,266	569	2,774	3,278	13,817	15,864	1,787	1,534	1,733	7,763	5,124	5,216	1,581	1,875	4,528	3,091	3,804
2013	4,879	1,590	149	2,010	2,398	10,882	14,082	997	854	1,003	11,235	3,244	3,320	1,863	3,024		2,041	2,332
2014	2,249	1,606	169	1,608	1,746	10,457	11,387	419	432	440		3,901	3,949	614	649		2,730	2,910
2015		1,852	447	1,408	NA	13,315	14,580	709	459	469		3,863	3,948	2,014	2,022		4,087	4,181
2016		NA	NA	2,429[5]	NA	16,761[5]	NA		844	NA		5,153	NA	1,287	NA		10,063	NA

Note: NA = Not available.

[1] Escapement estimated from MR studies conducted with Treaty-related funding.

[2] Estimate of total natural spawners (hatchery + natural) during the spring Chinook salmon escapement accounting period (prior to Oct. 1); includes some early-timed summer/fall Chinook salmon in the south Fork but is assumedly spring Chinook salmon only in the north fork/middle fork Chinook salmon (due to spawn timing differences).

[3] Natural-origin spring Chinook salmon isolated from total natural spawners based on carcass mark–sampling details (otolith thermal marks, fin clips, CWTs) and genetic stock identification.

[4] Escapement excludes brood stock collected for supplementation program. Total run includes redd count based escapement of all natural spawners, terminal catch, and adult brood stock collected for supplementation and PSC indicator program.

[5] Preliminary

Table B8.–Washington Coast escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Washington Coast																	
	Hoko Fall		Quillayute Summer		Quillayute Fall		Hoh Spr/Sum		Hoh Fall		Queets Spr/Sum		Queets Fall		Grays Harbor Spring		Grays Harbor Fall	
Year	Esc[1]	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run
1976			1,300	1,700			600	1,300	2,500	3,100	505	737	1,200	2,500	600	1,000	1,836	10,313
1977			3,800	5,300			1,000	2,000	2,100	3,800	732	1,155	3,600	5,500	800	1,700	5,195	14,400
1978			2,300	2,700			1,400	2,472	1,900	2,900	1,110	1,406	2,200	3,100	1,000	1,600	4,555	8,372
1979			2,100	3,900			1,400	2,326	1,700	2,200	870	1,369	3,900	4,700	400	1,100	9,381	10,101
1980			964	1,500	6,700	7,600	800	1,079	2,200	2,800	1,038	1,213	3,200	5,800	200	600	11,656	21,639
1981			815	1,700	5,963	7,102	1,498	2,005	3,100	4,000	988	1,329	4,250	8,200	600	900	7,577	11,915
1982			1,126	2,700	7,107	9,651	1,553	2,125	4,500	5,800	781	1,244	4,150	6,600	610	669	5,606	13,296
1983			548	1,800	3,069	5,530	1,696	2,233	2,500	3,300	1,044	1,173	2,750	4,400	800	850	5,482	8,997
1984			618	1,000	9,128	10,447	1,430	2,005	1,900	2,600	958	1,189	4,350	6,300	1,128	1,130	21,058	22,616
1985			550	700	6,145	8,367	978	1,353	1,725	2,720	677	886	4,150	5,910	1,157	1,159	9,537	15,153
1986	801	801	853	1,000	10,006	13,380	1,248	1,912	4,981	6,000	925	1,193	7,894	9,180	1,795	1,826	13,808	23,535
1987	581	581	666	1,600	12,352	20,349	1,710	2,480	4,006	6,147	598	1,543	6,557	10,638	841	1,071	19,013	34,460
1988	686	776	2,599	3,943	15,168	22,115	2,605	3,708	4,128	6,873	1,765	2,267	9,494	12,505	3,106	3,208	28,158	39,895
1989	775	842	2,407	3,472	9,951	17,260	4,697	6,820	5,148	8,682	2,568	3,954	9,324	12,213	2,068	2,393	25,677	56,028
1990	378	493	1,483	1,840	13,711	16,914	3,886	5,294	4,236	6,327	1,780	2,480	10,569	13,155	1,567	1,630	16,995	39,735
1991	894	1,006	1,188	1,500	6,292	7,631	1,078	1,693	1,420	2,628	630	761	4,795	6,593	1,289	1,489	14,392	33,271
1992	642	740	1,009	1,271	6,342	7,750	1,018	1,443	4,003	5,139	375	505	4,911	6,880	1,813	1,851	16,592	33,276
1993	775	894	1,292	1,531	5,254	5,735	1,411	2,065	2,280	3,951	713	788	3,463	5,667	1,254	1,399	13,349	28,941
1994	332	428	974	1,187	4,932	5,692	1,699	2,372	3,967	4,322	705	727	4,233	6,854	1,403	1,479	14,320	30,718
1995	750	905	1,333	1,731	5,532	6,716	1,132	1,686	2,202	2,912	625	662	3,127	5,101	2,070	2,167	12,727	31,729
1996	1,227	1,265	1,170	1,388	7,316	9,293	1,371	2,083	3,022	4,061	776	891	4,218	5,927	4,462	4,655	20,227	34,040
1997	768	894	890	1,177	5,405	6,047	1,826	2,582	1,773	3,034	540	693	2,872	4,945	4,460	4,812	18,168	30,842
1998	1,618	1,722	1,599	1,829	6,752	7,940	1,287	1,880	4,257	5,388	492	537	3,815	5,173	2,388	2,679	12,529	20,319
1999	1,497	1,688	713	818	3,334	4,758	928	1,081	1,924	2,941	373	426	1,794	3,105	1,285	1,555	10,363	12,846
2000	612	731	989	1,149	3,730	4,794	492	529	1,749	2,632	248	250	3,114	4,147	3,135	3,424	9,385	15,943
2001	768	946	1,225	1,399	5,136	7,545	1,159	1,231	2,560	4,116	548	565	2,872	4,775	2,860	3,326	9,492	19,397
2002	443	680	1,002	1,100	6,067	9,512	2,464	3,375	4,415	5,716	738	755	2,419	5,571	2,598	3,217	11,841	16,610
2003	863	1,098	1,219	1,308	7,398	9,469	1,228	1,646	1,649	2,345	189	195	4,811	6,611	1,904	2,101	19,871	22,866
2004	866	1,086	1,093	1,259	3,831	6,133	1,786	2,239	3,211	4,410	604	619	4,978	6,874	5,034	5,330	31,773	42,515
2005	203	284	876	1033	6,406	8,319	1,193	1,389	4,180	5,323	298	306	4,401	6,755	2,130	2,683	19,695	23,565
2006	845	895	553	604	5,642	7,656	904	1,061	1,535	2,336	330	336	2,931	4,266	2,481	2,863	17,428	24,928
2007	462	568	502	568	3,066	4,137	810	1,023	1,556	2,427	352	358	768	1,595	652	915	13,117	18,420
2008	431	483	949	1,081	3,612	5,250	671	717	2,999	3,911	305	305	2,971	4,208	996	997	15,391	18,661
2009	103	385	555	682	3,130	5,874	880	913	2,081	2,747	495	495	2,960	4,918	1,133	1,150	9,290	14,498

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	Washington Coast																	
	Hoko Fall		Quillayute Summer		Quillayute Fall		Hoh Spr/Sum		Hoh Fall		Queets Spr/Sum		Queets Fall		Grays Harbor Spring		Grays Harbor Fall	
Year	Esc[1]	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run
2010	319	793	772	941	4,635	6,985	828	852	2,599	3,204	259	259	3,861	6,001	3,495	3,495	18,158	25,795
2011	1,275	1,504	569	823	3,963	6,765	827	885	1,293	2,163	373	373	3,710	6,649	2,563	2,573	22,870	35,829
2012	401	663	729	841	3,518	6,682	915	1,059	1,937	2,770	760	760	3,586	6,757	878	1,151	14,034	24,788
2013	656	1,406	957	1,148	4,017	6,993	750	873	1,269	3,287	520	520	2,413	4,967	2,459	2,638	12,582	18,830
2014	1,534	1,760	608	843	2,782	7,327	744	819	1,933	2,628	377	452	3,684	5,145	1,583	1,659	11,400	19,369
2015	2,282	2,877	783	1,011	3,440	6,738	1,080	1,096	1,795	2,591	532	576	5,313	7,452	1,841	2,065	22,200	39,096
2016	965	1,195	871	1,155	3,654	5,252	1,241	1,256	2,831	2,994	704	NA	2,915	NA	926	NA	11,685	NA
Goal					3,000		900		1,200		700		2,500				13,326	

Note: NA = Not available.

[1] Escapement excludes brood stock for supplementation program. Total run includes redd-count-based escapement, terminal catch, and adult brood stock collected for supplementation and PSC indicator program.

Table B9.–Columbia upriver spring and upriver summer escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks.

	Columbia Upriver Springs[1]						**Columbia Upriver Summers**[2]	
	Upper Columbia R.		**Snake R. Spr/Sum**		**Total**			
Year	**Esc**	**t.run**	**Esc**	**t.run**	**Esc**	**trun.**	**Esc**	**t.run**
1975								
1976								
1977								
1978								
1979							18,797	22,142
1980	2,772	7,128	6,134	20,968	8,906	28,096	13,854	22,498
1981	3,253	6,044	11,318	24,753	14,571	30,797	8,639	18,746
1982	3,015	6,314	11,307	27,601	14,322	33,915	6,587	14,369
1983	4,286	7,292	9,845	20,936	14,131	28,228	6,334	13,145
1984	4,608	6,706	7,929	14,119	12,537	20,825	13,984	18,765
1985	8,941	10,290	10,682	14,865	19,623	25,155	14,505	18,522
1986	5,519	7,903	11,359	20,085	16,878	27,988	14,850	18,752
1987	6,352	8,777	10,140	15,870	16,492	24,647	13,415	22,715
1988	5,658	7,503	11,182	17,368	16,840	24,871	13,634	22,720
1989	4,130	7,455	6,499	14,707	10,629	22,162	17,484	22,201
1990	2,808	4,437	9,357	17,582	12,165	22,019	13,432	18,794
1991	1,533	2,437	5,756	13,106	7,289	15,543	10,191	14,323
1992	3,163	4,261	12,677	20,657	15,840	24,918	7,706	9,428
1993	3,102	4,050	12,531	17,911	15,633	21,961	12,927	14,021
1994	611	1,044	1,856	3,721	2,467	4,765	12,292	14,691
1995	108	224	1,167	3,395	1,275	3,619	10,623	12,455
1996	317	575	3,643	9,062	3,960	9,637	9,417	12,080
1997	746	1,222	5,055	9,620	5,801	10,842	10,063	17,709
1998	367	547	7,281	13,725	7,648	14,272	11,225	15,536
1999	284	401	2,853	5,525	3,137	5,926	18,588	21,867
2000	904	1,367	8,187	13,921	9,091	15,288	20,218	22,595
2001	4,807	6,252	44,572	63,195	49,379	69,447	48,844	52,960
2002	1,957	2,992	29,872	52,202	31,829	55,194	86,825	89,524
2003	1,581	2,198	32,080	50,645	33,661	52,843	81,543	83,058
2004	1,641	2,308	20,967	33,102	22,608	35,410	62,311	65,623
2005	2,080	2,807	9,832	15,146	11,912	17,953	54,033	60,272
2006	933	1,462	9,340	16,831	10,273	18,293	61,821	77,573
2007	398	458	6,903	10,351	7,301	10,809	28,222	37,035
2008	675	829	17,171	23,939	17,846	24,768	38,171	55,532
2009	1,089	1,086	14,313	20,242	15,402	21,328	44,295	53,881
2010	2,476	3,102	25,211	34,797	27,687	37,899	47,220	72,346
2011	2,167	2,639	23,844	30,519	26,011	33,158	44,432	80,574
2012	4,238	5,690	24,828	35,760	29,066	41,450	52,184	58,300
2013	2,553	3,449	13,916	22,307	16,469	25,756	68,380	67,603
2014	4,203	6,234	31,208	45,562	35,411	51,796	77,982	78,254
2015	4,872	7,306	21,910	29,967	26,782	37,273	88,691	126,777
2016	1,191[1]	1,660	16,188	24,239	17,379[1]	25,898	79,253	91,048
Goal							12,143	

[1] Preliminary estimate from Appendix B13 of PFMC Review Document. Final estimate will be provided upon completion of the Columbia River Compact Joint Staff Report

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[1] For the purposes of *US v. Oregon* management and tribal treaty/nontreaty allocation, the Columbia Upriver spring stock includes all fish destined to pass Bonneville Dam during the spring management period, including those destined for major tributaries such as the Deschutes and John Day rivers. These estimates of river mouth return and escapement are for only the adult upper Columbia wild spring Chinook salmon and the adult Snake River wild spring/summer Chinook salmon components. Escapements are past Rock Island Dam and past Lower Granite Dam (plus Tucannon River escapement), respectively. These are reported annually by the *US v. Oregon* Technical Advisory Committee (Joint Columbia River Management Staff 2013, Tables 8 and 9).

[2] Based on a stock–recruitment analysis of model data which included both hatchery and wild fish, an interim goal of 12,143 adult Mid-Columbia summers at Rock Island Dam was developed. For consistency with the goal, the escapement time series reported here was changed to the total adult Rock Island Dam count. The terminal run is that reported for Upriver summer Chinook salmon in the Joint Staffs Reports as the Bonneville Dam Count plus catch in lower river fisheries. These were also changed to include both hatchery and wild returns, where previously only naturally spawning returns were reported.

Table B10.–Columbia River fall Chinook escapements and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee Chinook salmon escapement indicator stocks.

	Coweeman				Columbia Upriver Fall Chinook				
	Total	CV	Lewis River[1]		Deschutes River[2]			Upriver Brights[3]	
Year	Esc	(Total)	Esc	t.run	MR Esc	Esc	t.run	Esc	t.run
1975	296		13,859	13,859	M-R			29,600	164,105
1976	528		3,371	3,371				27,700	109,338
1977	337		6,930	6,930		7,903	9,764	36,060	85,336
1978	243		5,363	5,363		5,393	7,364	25,798	77,936
1979	344		8,023	8,023		5,126	6,718	28,926	82,482
1980	180		16,394	16,856		4,106	6,057	27,708	70,743
1981	116		19,297	20,298		6,070	7,907	19,520	58,693
1982	146		8,370	10,126		5,513	7,529	28,313	71,471
1983	122		13,540	14,489		5,491	6,987	45,567	79,113
1984	683		7,132	8,128		2,779	3,749	52,266	127,651
1985	491		7,491	8,241		7,902	8,709	74,206	187,691
1986	396		11,983	13,504		7,467	8,620	93,051	272,949
1987	386		12,935	14,173		9,187	11,244	126,153	409,412
1988	1,890		12,059	13,636		9,548	11,939	98,220	327,976
1989	2,549		21,199	22,813		6,339	8,069	83,281	253,233
1990	812		17,506	18,784		2,864	3,834	49,020	149,759
1991	340		9,066	10,354		5,374	5,528	40,132	97,758
1992	1,247		6,307	7,129		3,668	3,705	41,434	77,311
1993	890		7,025	8,106		8,809	8,820	42,515	94,088
1994	1,695		9,939	10,541		9,556	9,625	66,645	123,214
1995	1,368		9,718	12,155		9,304	9,340	50,595	97,119
1996	2,305		13,971	13,971		10,233	10,311	53,049	132,882
1997	689		8,670	8,670		20,208	20,341	50,215	141,386
1998	491		5,929	5,929		15,908	16,415	42,113	125,886
1999	299		3,184	3,184		7,389	7,762	43,313	158,044
2000	290		9,820	9,820		4,985	5,392	60,988	150,352
2001	802		13,886	14,186	9,527	12,817	9,861	84,652	222,630
2002	877	0.05	16,380	18,230	11,133	11,907	12,125	116,858	265,144
2003	1,106	0.03	18,505	20,505	14,265	13,413	15,343	161,005	357,848
2004	1,503	0.12	15,342	17,133	10,197	10,197	11,421	148,212	356,437
2005	853	0.2	11,348	13,348	9,355	14,937	10,190	111,148	258,554
2006	566	0.1	10,522	11,999	14,196	14,223	14,981	76,252	215,407
2007	251	0.19	3,468	3,606	13,181	12,721	13,968	44,962	98,657
2008	424	0.11	5,200	5,200		6,908	7,614	72,713	189,681
2009	783	0.07	5,410	5,760		6,429	7,116	84,327	204,932
2010	639	0.12	8,701	8,701		9,275	10,066	165,726	314,842
2011	566	0.08	8,009	11,025		17,117	18,168	129,496	305,940
2012	463		8,143	8,450		17,624	18,785	130,414	276,483
2013	2,035		15,197	20,267		18,068	20,305	370,267	764,029
2014	890		20,808	22,915		17,993	19,432	299,391	664,807
2015	1,449		23,631	25,327		17,074	18,194	385,774	777,721
2016	407		8,957	10,463		11,628	12,390	189,358	394,182
Goal			5,700			4,532		40,000	

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[1] This is the number of naturally spawning adult fish in the Lewis River. The terminal run given is the escapement plus the Lewis River sport catch of wild adults.

[2] The first column gives the estimate based on a MR project for the entire river, which was used to verify the Sherars Falls estimates. The second column is the estimate based on using the ratio of redds above and below Sherars Falls. The time series of data through 2009 were updated based on a comprehensive analysis by Warm Springs, ODFW and Columbia River Intertribal Fish Commission (CRITFC) staff (Sharma, R, J. Seals, J. Graham, E. Clemons, H. Yuen, M. McClure, K. Kostow, and S. Ellis. Unpublished. Deschutes River Chinook spawner escapement goal using US v. Oregon Technical Advisory Committee data).

[3] The Columbia River Fisheries Management Plan (1988) stated an interim escapement goal of 40,000 natural spawning Upriver Brights at McNary Dam, including 38,700 for Hanford Reach and 1,100 Snake River. In 1990, the escapement goal was increased to 45,000 for increased hatchery programs. In 1994, a management goal of 46,000 was established, and in 1995, the management goal was retained while the escapement goal was reduced to 43,500. In 2002, the Columbia River Fisheries Management Plan (1988) escapement goal of 40,000 was agreed to by the Chinook Technical Committee. Escapement numbers given are McNary adult dam count minus adult sport and broodstock above the dam. The terminal run is the Columbia River mouth terminal run of Upriver Brights minus the Deschutes River fall Chinook salmon terminal run.

Table B11.–Oregon Coastal escapements as estimated via traditional habitat expansion methods and terminal runs (t. run) of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks.

	Oregon Coastal							
	Nehalem R.		Siletz R.		Siuslaw R.		Coquille R.	
Year	Esc	t. run	Esc	t. run	Esc	t. run	Esc	t. run
1975	5,197	5,303	2,062	2,689	4,427	4,548	4,927	NA
1976	9,807	9,908	1,326	2,036	7,999	8,153	2,188	NA
1977	11,478	12,093	3,314	3,919	9,492	10,362	4,379	NA
1978	12,059	12,244	2,062	3,700	5,872	6,879	3,951	5,290
1979	12,205	12,469	7,217	8,907	8,040	8,799	4,030	4,715
1980	5,555	5,832	3,680	4,820	10,630	11,183	4,014	4,622
1981	10,752	10,939	4,435	6,751	8,724	9,342	4,313	4,996
1982	5,085	5,282	3,415	4,514	10,870	11,774	6,249	6,865
1983	4,431	4,525	2,136	3,152	4,186	4,885	3,193	3,807
1984	20,341	21,623	3,461	4,552	11,168	12,437	4,502	5,164
1985	18,670	19,473	6,628	7,685	14,822	15,805	3,157	3,853
1986	10,389	11,920	6,748	7,799	14,844	15,965	4,470	5,125
1987	13,560	15,725	4,577	6,023	17,603	19,411	5,640	6,997
1988	14,889	17,185	7,805	9,257	41,746	44,380	7,451	8,635
1989	10,389	12,000	4,401	5,980	28,279	31,690	6,462	7,820
1990	5,104	6,789	4,313	5,373	26,799	29,593	6,064	7,567
1991	5,557	7,685	5,633	6,926	26,100	29,825	9,074	11,470
1992	9,060	11,863	6,044	7,460	26,090	28,350	13,293	15,911
1993	5,345	9,317	4,342	6,506	10,446	14,012	6,993	10,419
1994	6,486	9,412	10,475	12,188	23,570	25,890	6,698	8,696
1995	5,194	8,845	5,164	8,045	26,715	31,194	7,885	10,374
1996	9,211	13,285	7,394	10,274	33,051	39,705	6,346	8,790
1997	10,026	13,069	3,726	6,165	22,305	27,516	6,743	8,338
1998	8,245	10,869	5,516	7,175	24,708	28,882	9,930	12,680
1999	8,063	10,632	4,166	6,232	23,963	27,271	8,513	10,950
2000	6,855	9,119	6,787	9,462	15,730	19,588	6,684	8,974
2001	11,662	15,998	10,563	14,704	38,717	43,836	8,233	12,007
2002	18,089	22,657	14,054	19,019	41,058	47,905	11,848	15,578
2003	10,906	15,095	11,149	15,693	58,998	66,246	16,482	21,572
2004	9,975	14,792	3,902	10,419	40,033	46,062	11,346	14,041
2005	8,114	9,535	6,631	8,931	17,618	19,301	5,029	5,767
2006	4,711	5,902	4,108	6,194	28,082	29,926	3,009	3,790
2007	4,304	5,759	528	1,536	6,764	9,665	2,098	3,557
2008	3,810	4,865	1,202	1,682	11,119	12,405	4,562	5,813
2009	5,390	5,390	2,905	3,343	14,094	15,881	12,308	13,530
2010	5,384	7,254	4,225	5,118	22,197	25,846	32,318	36,940
2011	7,665	9,780	3,638	5,861	30,713	36,546	16,745	21,151
2012	7,515	10,068	4,812	6,657	20,018	24,112	9,300	12,541
2013	18,194	22,073	7,364	10,836	23,411	32,213	5,836	9,431
2014	11,452	16,210	8,655	13,136	28,200	34,750	10,418	14,978
2015	12,678	18,660	6,367	14,335	35,087	45,169	12,409	19,046
2016	10,074	NA	8,479	NA	30,135	NA	5,048	NA
Goal	6,989		2,944		12,925		pending	

Table B12.–Oregon Coastal escapements and terminal runs (t. run) as estimated by MR calibrated indexes of Pacific Salmon Commission Chinook Technical Committee wild Chinook salmon escapement indicator stocks. Estimates presented in boldface represent estimates generated from direct MR studies.

Year	Oregon Coastal						
	Nehalem R.		Siuslaw R.		Umpqua R. S. Fork	Coquille R.	
	Esc	t. run	Esc	t. run	Esc[1]	Esc	t. run
1975	4,954	5,060	2,567	2,567	NA	6,668	NA
1976	9,345	9,446	4,565	4,565	NA	2,766	NA
1977	10,937	11,552	4,531	4,531	NA	5,676	NA
1978	11,491	11,676	2,867	3,874	400	5,618	6,957
1979	11,794	12,058	3,554	4,313	NA	5,203	5,888
1980	5,368	5,645	5,483	6,036	697	5,952	6,560
1981	10,390	10,577	3,767	4,385	890	6,405	7,088
1982	4,914	5,111	5,094	5,998	1,011	8,885	9,501
1983	4,282	4,376	923	1,622	1,628	4,686	5,300
1984	19,657	20,939	3,384	4,653	2,594	6,229	6,891
1985	18,042	18,845	6,845	7,828	2,246	4,498	5,194
1986	10,039	11,570	6,513	7,634	1,573	5,642	6,297
1987	13,103	15,268	5,568	7,376	2,795	6,429	7,786
1988	14,388	16,684	14,935	17,569	3,778	8,389	9,573
1989	10,039	11,650	12,856	16,267	6,162	6,948	8,306
1990	4,932	6,617	13,662	16,456	3,761	7,738	9,241
1991	5,370	7,498	15,709	19,434	6,717	10,508	12,904
1992	8,755	11,558	13,221	15,481	8,149	16,636	19,254
1993	5,165	9,137	2,960	6,526	3,364	7,446	10,872
1994	6,268	9,194	9,477	11,797	7,128	6,866	8,864
1995	5,020	8,671	10,246	14,725	11,388	12,060	14,549
1996	8,901	12,975	15,788	22,442	10,019	7,618	10,062
1997	9,689	12,732	8,313	13,524	7,286	8,580	10,175
1998	7,967	10,591	5,456	9,630	1,104	11,877	14,627
1999	7,792	10,361	11,785	15,093	1,804	10,653	13,090
2000	**10,678**	**13,943**	4,648	8,506	3,140	7,880	10,170
2001	**12,431**	**16,767**	**9,723**	**14,482**	6,510	**12,512**	**16,286**
2002	**19,956**	**24,524**	**22,506**	**29,353**	3,831	**13,675**	**17,405**
2003	**21,283**	**25,472**	**28,801**	**36,050**	8,918	**18,876**	**23,966**
2004	9,639	14,456	**29,119**	**35,148**	7,487	**11,668**	**14,363**
2005	6,801	8,222	**13,771**	**17,700**	3,084	5,438	6,176
2006	11,938	13,129	**13,380**	**17,449**	2,396	7,438	8,219
2007	5,193	6,648	3,920	6,821	2,457	2,098	4,037
2008	4,596	5,651	4,544	5,830	2,333	5,803	7,661
2009	**5,786**	**5,786**	5,237	7,024	3,014	15,653	16,875
2010	**7,097**	**8,967**	11,165	14,813	6,184	41,104	45,726
2011	**11,084**	**13,199**	11,909	17,742	7,550	21,291	25,697
2012	**12,952**	**15,505**	16,314	20,408	5,635	11,828	15,069
2013	**15,989**	19,868	17,452	26,254	10,704	7,423	11,018
2014	13,817	18,575	**16,395**	22,945	7,153	13,250	17,810
2015	13,321	19,303	19,361	29,443	17,021	15,782	22,419
2016	12,456	NA	8,586	NA	NA	9,720	NA
Goal	pending		pending		pending	pending	

Note: NA = Not available.

[1] Preliminary analysis has shown that terminal catch of South Fork Umpqua River fall Chinook salmon is negligible.